

NOV 10 1919

VOLUME 2

NUMBER 5

ARCHIVES OF NEUROLOGY AND PSYCHIATRY

EDITORIAL BOARD

HUGH T. PATRICK, Chicago

PEARCE BAILEY, New York

AUGUST HOCH, ~~Massachusetts, Calif.,~~ ~~London~~

E. E. SOUTHARD, Boston

FREDERICK TILNEY, New York

T. H. WEISENBURG, Philadelphia

NOVEMBER 1, 1919

PUBLISHED MONTHLY BY AMERICAN MEDICAL ASSOCIATION, 535 NORTH
DEARBORN STREET, CHICAGO, ILLINOIS. ANNUAL SUBSCRIPTION, \$1.00

Entered as second-class matter January 7, 1919, at the postoffice at Chicago, Illinois, under the
Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in
section 1103, Act of October 3, 1917, authorized January 15, 1919.

CONTENTS OF PREVIOUS NUMBERS

AUGUST, 1910. NUMBER 2

The Physician and Human Conservation. James H. McBride, M.D., Pasadena, Calif.
Cerebrospinal Fluid in Experimental Compression of the Spinal Cord. James B. Ayer, M.D., Baltimore.
A Clinical Survey of 415 Instances of Brain, Spinal Cord and Peripheral Nerve Injuries, as Seen in Overseas Wounded. Report of Several Unusual Cases. J. C. Fisk, M.D., and Samuel Brock, M.D., New York.
The Colloidal Gold Reaction in Four Hundred and Ninety-Eight Psychiatric Cases. Eva Rawlings, M.D., California.
The Role of the Pituitary Gland in Epilepsy. Beverley R. Tucker, M.D., Richmond.

The Resemblance of the Sensory Symptoms of Post-Diphtheritic Ataxia to Those Seen in the Cord Changes of Severe Anemia. George Wilson, M.D., Philadelphia.
The Diagnosis of "War Psychoses." George E. McPherson, M.D., Medfield, Mass., and Leslie B. Hohman, M.D., Baltimore.
Abstracts from Current Literature:
The Symptoms of Acute Cerebellar Injuries Due to Gunshot Injuries. Gordon Holmes, M.D. Extrameningeal Meningococcus Infections. W. W. Herrick.
Society Transactions:
New York Neurological Society.
New York Academy of Medicine.
Philadelphia Neurological Society.

SEPTEMBER 1910. NUMBER 3

Peripheral Nerve Injuries Concomitant to Gunshot Wounds. Irving J. Spear, M.D., and W. W. Babcock, M.D., Fort McPherson, Ga.
Bulbar Paralysis or Amyotrophic Lateral Sclerosis? A Clinico-Pathologic Note. G. B. Hassin, M.D., Chicago.
Lethargic Encephalitis. Josephine B. Neal, M.D., New York.
Psychoses Associated with Influenza. K. A. Menninger, M.D., Topeka, Kan.
Sensory Changes in Peripheral Nerve Injuries. L. I. Grimberg, M.D., New York.

Abstracts from Current Literature:
Pathogenesis of Diphtheritic Paralysis. The Operative Treatment of Spastic Paralysis (Hemiplegia, Monoplegia, Paraplegia) in Gunshot Wounds of Head and Spinal Cord. Diamorfin Endocrine. The Problem of Fatigue. Pituitary Disturbance from Adenoids. Sugar Tests in Hyperthyroidism and Other Endocrinal Disorders. Cerebral Hemorrhage of the New-Born.
Society Transactions:
New York Neurological Society.
Book Reviews:
The Autonomic Functions and the Personality. Neurologic Clinics. Cesare Lombroso.

OCTOBER, 1910. NUMBER 4

Therapy of Neurosyphilis Judged by Arsenic Penetration of Meninges: Methods of Treating Neurosyphilis. H. G. Mehrtens, M.D., and C. G. MacArthur, San Francisco.
Locomotor Disturbances in Disease of the Cerebellum: A Graphic Study. I. Leon Meyers, M.D., Chicago.
The Action of Certain Drugs on Brain Circulation in Man. Theophile Raphael, M.D., and James M. Stanton, M.D., St. Louis.
A Study of the Invalid Reaction. Esther Loring Richards, M.D., Baltimore.
A Study of Hysteria, Based Mainly on Clinical Material Observed in the U. S. Army Hospital for War Neuroses at Plattsburg Barracks, N. Y. Aaron J. Rosanoff, M.D., Kings Park, N. Y.

Status Lymphaticus: Its Occurrence and Significance in War Neuroses. Thomas K. Davis, M.D., New York.
Abstracts from Current Literature:
The Role of Focal Infections in the Psychoses. Aphasia and Associated Speech Problems. Receducational Treatment in Aphasia. Contribution to the Study of Luetic-Epilepsy.
Society Transactions:
Chicago Neurological and Chicago Pathological Societies.
Philadelphia Psychiatric Society.
Chicago Neurological Society.
Book Review:
Vegetative Neurology.

Archives of Neurology and Psychiatry

Vol. 2

NOVEMBER, 1919

No. 5

SOME NEUROLOGICAL ASPECTS OF RECONSTRUCTION *

HARVEY CUSHING, M.D.

BOSTON

A few weeks ago I received a visit from two recently discharged soldiers who may be designated as Pte. L. and Pte. A. The former, a cripple, was being assisted by a young man still in uniform, to all appearances in perfect health. I shall briefly tell their separate stories.

Pte. L—, a member of the organization with which I went overseas, had been the victim of an air raid on Sept. 4, 1917, when several bombs were dropped on our hospital compound, resulting in many casualties. The reception tent, in which he with several others was on duty, received a direct hit. Two were killed outright, and he was so seriously wounded that a double amputation—the right thigh and left lower leg—was necessitated. A few hours later, owing to a galloping gas infection due to the multitude of indriven splinters from the badly contaminated wooden floor of the tent, the left leg was again amputated this time in the mid thigh by (then) Capt. E. C. Cutler.

Pte. L— recovered. In due course he was evacuated to a base port, and after the customary delays was returned home where he received the abundant sympathy, care and favor apportioned to amputés. After being fitted with artificial limbs on which he is learning to walk with some assistance, he finally received his discharge on Feb. 10, 1919, with a surgeon's certificate of 100 per cent. disability entitling him with his insurance to a compensation of \$157.50 a month. An intelligent and ambitious young man, he is now a student at the Institute of Technology.

Pte. A—, the soldier who accompanied and assisted the cripple, was a fine appearing young fellow over whose prospects, however, his friend and companion expressed great concern. A private in the 26th Division, he had received a head wound, with immediate loss of consciousness, Sept. 12, 1918, in the early hours of the St. Mihiel attack. He appears to have been removed promptly from the field, to have passed the 101st Field Ambulance, and to have reached Mobile Hospital No. 1, stationed near Ancémont, some 10 miles from the line. There he was operated on about twelve hours after the injury by (then) Capt. Charles E. Dowman, the senior officer of one of the neurosurgical teams. As the members of these teams kept and forwarded to me duplicate notes of their head cases, Capt. Dowman's record of this man's operative history was in my possession. To illustrate the character of the observations

* Read before the Congress of American Physicians and Surgeons, June 16, 1919, at a symposium on the subject of Medical and Surgical Reconstruction.

made by the officers of these hurriedly assembled teams, to all of whom I am under lasting obligations, this record may be given in full.

A—, John C., No. —, Pvt. Hqs. Co., 102 F. A. Left parieto-occipital gutter wound with dural and brain penetration of bone fragments.

Admitted Mobile Hospital No. 1, 11:10 a. m., Sept. 12, 1918. Tagged 101 Amb. D. S., 9 a. m., Sept. 12, 1918.

A. T. S.: Yes. A history of the exact time of injury or how patient had been injured could not be obtained on account of an apparent aphasia. "No signs of paralysis; vomiting at 10 a. m." noted on diagnosis tag.

General Condition:—Patient conscious but unable to talk. Pulse 54; blood pressure 130-75-55.

Wound:—Transverse, tangential, left occipital region, measures 10 by 4 cm. ragged edges of torn scalp; exposed brain with evident loss of brain substance. Roentgen-ray report: "No foreign body in brain. Indriven fragments of bone, left occipital region. Foreign body (high explosive) 18 by 10 mm. in lower end of right tibia."

Neurological Findings:—Aphasia. When asked when he was wounded answered "tonith." Recognizes objects but is unable to call their names properly. Calls a match "penth," and later calls it "menth." Agraphia. Unable to write name, though he spelled his name J-O-H-N as he attempted to write it. Loss of muscle sense in right hand. (Is right-handed.) No loss of sensation to pin-prick right or left. Slight weakness (emotional) right side of face. Right hand grip weaker than left. Pupils dilated, but equal right and left. Abdominal, epigastric and cremasteric reflexes absent right and left. K. K. hyperactive both sides, more so left. Achilles tendon active right and left. Babinski reflex present, right, suggestive left. A complete right homonymous hemianopsia.

Operation:—Sept. 12, 1918, 8 p. m. (about 12 hours). Pulse had come up to 80 per min. Novocain-epinephrin after preliminary one-third grain morphin. Three-legged incision made with excision of wound in scalp; block removal of bone; débridement of brain by suction, with removal of numerous bone fragments and considerable contused brain substance. Wound in dura was 2 by 1.5 cm.; treated by excising soiled edges. Two bleeding points tied with fine silk. Scalp closed with interrupted silkworm gut. A small foreign body removed from scalp of vertex. No drainage.

Gunshot wound posterior surface right leg, 5 cm. above ankle. Under novocain wound was debrided and shell fragment removed from lower end of tibia.

Postoperative Course:—Sept. 13. Pulse 100; patient brighter. Tries to talk but is unable to call objects by their proper names. Eye grounds normal.

Sept. 14. Pulse 80. Able to say a few words. Strength in right hand improved; general condition good.

Sept. 15. Every other stitch removed. Healing reactionless. Aphasia improving slightly. Brain pulsating.

Sept. 17. All stitches removed. One or two drops of cloudy fluid from center of wound. Aphasia improving. Right hemianopsia the same.

Sept. 21. Evacuated.

The subsequent story as I learned from my two visitors was as follows: From Mobile Hospital No. 1 he was removed to an evacuation hospital stationed near by; then after two weeks as a stretcher case to Base Hospital No. 26 at Allerey, then to St. Nazaire and finally to Brest. By this time he was able to be up and about and on Nov. 11 he was returned on an army

transport. He landed at Newport News and was sent from there to a base hospital, from which place, being so far recovered that he supposedly could travel alone, he was discharged December 7 with orders to "report for duty" at the convalescent center near his home. He was found wandering about the once familiar streets of Boston, of the names and direction of which he had lost all recollection; an ambulance was secured and he was taken to the local army hospital where arrangements were made for his admission. He remained there four months.

Before his enlistment he had been an expert accountant, and as he had completely lost his ability to deal with figures he was assigned to a class in the hospital with others who were learning arithmetic. The exercises, however, according to his statement, were so far beyond him that he merely became confused and soon ceased to attend them. Finally on April 7, 1919—"condition: maximum improvement obtained"—he was brought before an S. C. D. Board of junior officers (neuropsychiatry not represented) and was given 90 per cent. disability. This entitled him to a compensation of only \$27.00 a month, for curiously enough any percentage disability below 100 per cent. is reckoned on a \$30.00 a month basis.

I shall resist the temptation to go into the details of the young man's residual symptoms further than to say that mild excitement, stooping, or any slight physical exertion, causes his brain to "pound" as he describes it. There are occasional periods of numbness and contraction in the right hand and arm suggestive of early jacksonian seizures. Though his hemianopsia has subsided, there remains a marked sensory aphasia (agraphia), lacunar amnesia and a definite slowing of his mental processes.

I am aware that these circumstances may be unusual; that the status of both these men is subject to revision; that judgment even by an expert, if one is to be had, regarding the future of post-traumatic mental derangements is difficult and often fallacious. I fear, however, that in this recital of a chance episode I am merely telling what in the main can be duplicated in most, if not all of the many hospitals which receive the victims of these craniocerebral injuries.

The story has been told, however, in order to compare the treatment and the reward afforded to a soldier without legs who has resumed his studies and will be perfectly capable in all probability of earning his livelihood, and the soldier to outward appearances physically intact, who has a cerebral defect with a residual abyss in his mental processes which no amount of reeducation will ever enable him completely to bridge and who suffers therefore from a handicap incomparably greater than the amputé, so far as his future outlook is concerned. Both Pte. L. and Pte. A. know this as well as I.

Now the subject which has been apportioned to me for this occasion is the "Neurological Aspects of Reconstruction," and for several reasons I suffer from considerable embarrassment in approaching it. In the first place the word "Reconstruction," useful as it may have been and still is as a means of focusing public attention on an idea —

like the word "Conservation"—appears to me to be in danger of being so greatly overworked that the medical profession is likely to forget that it merely represents in our present connection the later treatment—the making over—of our disabled soldiers. It is precisely what, admittedly in smaller scale, the personnel of the medical and surgical and social service departments of every well-conducted civil hospital has in the past attempted to do for its patients—to restore them to a life of greatest usefulness. Indeed, in some communities, like my own, there is what is called a Tide-Over League where occupational therapy, possibly begun in the wards, is continued; and this is supplemented by the State Industrial Accident Board which has a department for vocational training. The process in each case is the same, and I have some misgivings, lest lulled by the magic of this shibboleth, we may fail to observe that the same defects in our existing hospital organization, in our professional training, and the same unfamiliarity with the more difficult bypaths in medicine, particularly those relating to the psychology and behavior of the individual, exist as before.¹

Another source of embarrassment lies in the fact that my particular relations to the wounded soldiers have been largely confined to the more acute aspects of treatment—the immediate saving of life by the early operative intervention in the case of craniocerebral wounds. Regarding this early stage, alone, of the process of making over our wounded, in so far as it has been possible overseas to influence it from a neurological point of view, I can speak with some familiarity, and what I may have to say of the subsequent stages of this and other neurological problems represents the impression merely of an interested and sympathetic onlooker.

Unfortunately, as physicians and surgeons, we in general know less about the nervous system and its disorders than we do of the disorders of any other part of the body. Despite its unquestioned importance from a broad national and sociological point of view, as well as from

1. In many civil hospitals, indeed, efforts have been made to introduce elementary vocational training but, as seems to be the case with the majority of our wounded soldiers, patients are loath to go to school in a hospital. In the army hospitals I have visited, the shops and classrooms, alas, tend to be empty, and particularly those in the larger cities have, in the shape of an entertainment committee, a serious competitor for the soldiers' favor. In some institutions this has reached such a stage that it has been necessary to issue orders for convalescents to go into the shops for a certain number of hours a day on the basis that the work was an essential part of the treatment of their disability, as it often is. In the long run the men who are privileged to wear stripes make admirable patients as long as there is anything serious the matter with them, but subsequently they become difficult to handle. As one of them put it to me "they don't see the use of spending their time in shops making toys for children."

the standpoint of each person, the subject, possibly due to its complexity, is largely shunned, and the mental hygienists, the psychiatrists, neurologists, and more recently the neurosurgeons of the country who are endeavoring to be heard but represent a small voice, and that not a concerted one, to which Medicine in general has paid scant heed, and which is now quite lost in the uproar of Reconstruction.

Unquestionably, the wear and tear of modern life falls most heavily on the nervous system. This is true of peace no less than war, but in time of war with its additional strain, shared by all both in and out of uniform, sane minds are in the long run more essential to the country's welfare than sound bodies, important as these are. I recall with interest the nature of the official physical examination to which, in May of 1917, the volunteers enlisting for our hospital unit were subjected. It was a matter largely of teeth, of toes, of stature and of inguinal rings. In the absence of mental or neurophysical tests many candidates who would have received high marks on these scores were rejected, and the reverse was equally true. Fortunately, after the draft was adopted the character of these examinations was greatly improved. Psychiatrists appeared on the examining boards and a large number of prospective soldiers showing neuropathic tendencies, who obviously would not endure the rigors and restrictions of military training, were screened out together with the physically unfit. The startling thing from the standpoint of our national well being was the number of cases so rejected.

In spite of this careful combing out, a large number of the accepted, when subjected to the strain and disciplinary restraints even of camp life near the theater of war, developed psychoneuroses which proved their unfitness for service; and, as you well know, a great many soldiers with nervous systems sufficiently stable to withstand these lesser trials broke down when the influence of high explosive was added to the stress already imposed by fatigue and excitement.

No compliment too great can be paid to the organization with its series of hospitals which Colonel Salmon established in France to meet these problems, and the recent report by Lieut.-Col. Sidney I. Schwab² of what he calls the "A. E. F. conception of the war neuroses" is one of the notable contributions to psychiatry which has come out of the war.

To these aspects of the disorders of the nervous system the entire energies of the neuropsychiatrists who were in service overseas was concentrated, as it is perhaps essential that they should have been, in

2. The War Neuroses as Physiologic Conservations, *Arch. Neurol. & Psychiat.* 1:579-635 (May) 1919.

view of the incessant wastage which was known to have occurred in the allied armies from these sources. The problem was urgent; the treatment to be effective had to be put in operation before opportunity arose for the neuroses to become a fixed habit.

As the few neurologists who were available became engulfed with the psychiatrists in this important work, the nervous disorders of organic origin were perforce somewhat neglected, though it was apparent to all that these cases would sediment in our hospitals and represent the final precipitate of the war injuries — and not only the last, but the most difficult with which to deal.

Meanwhile, under a program of which we had scant tidings abroad, military surgery in our army was variously subdivided into general, orthopedic, genito-urinary, and so on, with a department for surgery of the head to include the diseases and injuries of the eye, ear, face and jaws, as well as of the brain itself. Though this was a sufficiently workable program, it unfortunately did not fit in with the plans adopted overseas, and the decision was made, I believe, in the spring of 1918 to place the injuries of the nervous system as a whole under a department of neurological surgery. This would seem the more natural arrangement, and it appears from the syllabus of the courses³ offered in the excellent neurosurgical schools which came to be established in New York, Philadelphia and St. Louis, where the instruction was in the nature of a general survey of the peripheral as well as the central nervous system, that the final tendency at home was in the same direction.

It was not until June, 1918, that a neurosurgical consultant was appointed for the A. E. F. and authorized to organize a service. No precedent covering the activities of such a department existed either in the French or British armies, nor were there any available figures that would serve to give an idea of its probable responsibilities beyond the rough computation from a series of 10,000 wounded in the French 6th Army that 25 per cent. of all battle casualties presented neurological problems of one sort or another; that the major peripheral nerves were

3. These admirable courses in which neurologists and neurosurgeons combined were such as might well be continued as graduate courses on a peace basis for which they were perhaps better adapted than for the actual surgical treatment of war wounds which, as a matter of experience, can only be learned where they occur. These schools, however, have well justified their establishment if they did nothing more than increase the general interest in neurological surgery, and doubtless with the less urgent though equally important reparative neurological work which is still to be done, the labor which the instructors put into these courses will justify itself in the broader neurosurgical point of view of their many pupils.

involved in 20 per cent. of all serious injuries of the extremities, and that wounds of the head, including all types, represented 16 per cent. of all battle wounds.

Estimates such as these based on figures secured from certain engagements in certain periods of the war may, however, fail to represent the percentages which occur under changed conditions of warfare. In the open battles in which our forces came to participate, with almost as much actual exposure to machine-gun fire as to high explosives, the injuries on the whole were altogether of a different character, far less severe and far less provocative of sepsis than those to which some of us had been accustomed during the preceding year as a result of the battles in Flanders. For although the enemy's system of machine-gun defense by isolated concrete emplacements was first encountered during the Passchendaele operations, high explosive was nevertheless so predominant as to be the cause, at least in the case of head wounds, of practically all the examples.

It was the custom in the British army to cluster in twos or threes their casualty clearing stations (comparable to our evacuation hospitals) which had been developed during the war. During the tragic months of the battles for the Ridges, one of these hospital clusters behind the 5th Army was given over entirely to the reception of the army head cases, together with the walking wounded and the gassed cases from the nearest corps. By this arrangement a sufficient number of beds was made available for the retention of craniocerebral injuries which, as experience has shown, do not stand transportation well after operation, but must be held like other wounds in which primary closure has been attempted. Though the pressure of work was great at times,⁴ the conditions were nevertheless ideal for the encouragement of detailed clinical observation. Whenever opportunity offered, there were inter-hospital meetings; accurate though brief clinical records were taken on duplicating books which were provided, and through the agency of postcards supplied by the British Research Committee—cards which accompanied the patient on his evacuation and carried the surgeon's address—a follow-up system was possible so that prompt returns could be secured from both base and home hospitals, and a final report of the condition, if requested, was made by the Research Committee on the patient's discharge from service or resumption of duty.

4. For example, during the first two weeks' period, July 26 to August 8, including the single opening battle of July 31, there were 1,017 head cases admitted out of 9,103 admissions.

IMPRACTICABILITY OF BRITISH FOLLOW-UP SYSTEM FOR
AMERICAN ARMY

So far as circumstances permitted, the effort was made to introduce the main features of this system for the benefit of the neurosurgeons operating in advanced hospitals in our own army.

The essential functions of an army hospital are the registration of the wounded and their evacuation. Treatment, aside from first aid, necessarily comes last, and the farther forward the hospital is situated the more closely must this order of obligations be observed. Nevertheless, an army hospital, no less than civil hospital, has unwritten obligations which are often neglected and which lie apart from its administrative work — the detailed care of the individual patients, the training of junior officers representing the students, the proper utilization of material for the furtherance of our knowledge of the problems confronting us. Admittedly, research does not often thrive within the sound of battle, but nevertheless a spirit of inquiry may be kept alive. For such a low order of investigation as the mere study and tabulation of groups of cases and their end results is not infrequently of very great value.

The conditions in our overseas army medical units were very much like those of the divisional units. Medical officers, like battalions, often had to be thrown into gaps regardless of special training or fitness, and it is perhaps astonishing that they accomplished as much as they did. There were, doubtless, many misfits — men in the line who had never fired a rifle — surgeons in forward hospitals who had never seen a war wound and who had been instructed at home in such principles as the Carrel-Dakin treatment or the primary closure of wounds, neither of which could be put into practice under the conditions which for the most part confronted us in the A. E. F.

That good work may be done and careful records kept under these circumstances is exemplified by the clinical note from an evacuation hospital which chance had led me to quote, but I must confess to the fact that with us a follow-up system was impracticable; the records for the most part were poorly kept or not at all, for few organizations had any field medical cards; and that even when — as was true of the duplicates of the notes I have quoted — they *were* sent on with the patient they rarely reached their destination.⁵ Surgeons were thus precluded, in forward areas at least, from any possibility of acquiring personal information, much less of advancing general knowledge, by

5. In the hospitals in which I have made inquiry I am told that about 75 per cent. of our wounded arrive at the base hospitals here with proper army forms, but very few of them with any clinical records whatsoever from overseas.

the study of end-results except by hearsay evidence of the condition in which their operated cases reached the base. Moreover, by the time the July offensive began, things moved so rapidly with our entire army organization that little more could be done than to locate as many surgeons as possible who had had neurological training or even interests, to equip them so far as could be done with proper tools and see that each mobile and evacuation hospital had at least one neurosurgical team reasonably capable of properly caring for injuries of the brain.⁶

Organization and Work of American Neurosurgical Teams.—The story of these neurosurgical teams, as well as of the general situation in France, is told in a final report to the chief surgeon. This will be found in full in the author's reprints.

We are at the present juncture much more concerned with the problems now confronting us than with those of the past. During our last weeks in France, representatives of Colonel Salmon's department and of my own had been stationed at the chief hospitals at the ports of debarkation, with the object not only of tabulating all of the cranial, spinal and peripheral nerve cases, but of insuring the fact that they did not leave France unaccompanied by a detailed note of their neurological condition. We expected that at the port of entry a sorting station would be established, and that the from 3,000 to 4,000 neurological patients would be routed thence to one or two large centers where would be stationed medical officers particularly competent to handle them—psychiatrists, neurologists, neurosurgeons and orthopedists, selected on the double score of greatest experience in dealing with these particular conditions and greatest likelihood of advancing our incomplete knowledge by a thorough comparative study of this large material. Such an establishment, coupled with a laboratory for experimental neurology which Major L. H. Weed had so profitably conducted in Baltimore during the war and profiting by the studies made by Professor Huber at Ann Arbor, would have put our contributions on a parity with the brilliant studies which have been made during the past four years by the British and French neurologists, and carried over to civil life might leave us with a distinctly American "School of Neurology" under a permanent and central organization.

Similar ideas were in the minds of those at home, but something more than the ocean was interposed between our overseas and our

6. The importance of special training for this kind of work may be gathered by quoting the figures from one hospital during a certain engagement. In a series of thirty-eight cases of dural penetration operated on by the single neurological team, there was an operative mortality of 29.4 per cent., whereas twenty-six cases operated on by eleven different surgeons without equipment or training, in the same hospital, gave 62 per cent. mortality.

home programs in this and I fear in other departments as well, which not even wireless nor the cable seemed able to penetrate.

It is perhaps understandable why the more natural and effective plan was not adopted at the outset. There were many influences at work and the result has been that neurological patients, like most others, have come to be more or less widely scattered in many army hospitals, and short-sighted parents have even gone so far as to remove their wounded boys from army auspices in order to send them to their own choice of physician. But he is therapeutically helpless when compared to a group of medical officers who have numberless examples of the same lesion under their observation, with every facility at hand for the elaborate studies and after-care essential to the best results of surgery in this difficult type of case. This work has been done admirably at some hospitals like those at Cape May and Fort Sheridan, but we cannot reduplicate superior ability indefinitely—the special cases must be routed to the place where ability is available and this, I think, we are going to find true when we come to translate the lessons of military to industrial surgery. Unquestionably, a program of reconstructive treatment for disabled soldiers in a modern hospital is much more likely to be effective than any similar program for the care of industrial injuries, unless done in the mass and on a state or national scale, because the treatment and reeducation can be enforced on reluctant and short-sighted individuals, because inter-departmental cooperation can also be enforced, because the number of cases of a given type can be brought together so that wide experience with a given problem can be acquired, and lastly, because in the army, medical officers are giving—or should be able to give—their full time to these problems, undistracted by administrative details or by outside calls on their time.

We are tending to fall short of our immediate opportunities for a number of reasons, some of which I have mentioned—the insistence that the wounded be distributed to hospitals sufficiently near their homes so that relatives may have access to them; the irresistible tendency on the part of parents to remove wounded soldiers from army auspices and place them under the care of their local civilian physicians or surgeons; the desire of medical officers to withdraw from the service; the unquestioned let-down in the activities of all war-weary people which followed on the armistice and which seriously militates against the effective carrying out of policies already accepted and seriously blocks the adoption of any newly constructive ones.

So far as the neurological cases are concerned, though late it is not too late to reassemble them, for as I have indicated they will sediment in our several hospitals as the dregs of the casualty lists when

nearly all others have been discharged. It is understood that steps are now being taken in this direction and it is wise, for neurological problems are very special ones, whether they lie in the province of the neurosurgeon or the psychiatrist, and the proper sort of operation, if any, no less than the proper sort of vocational training to be given to a soldier with a cranial defect and perhaps subject to epilepsy, may well tax the judgment of experts far more than other problems of surgical reconstruction.

We hope, therefore, that the desired congregation of these cases may be brought about and possibly under the auspices of the War Risk Insurance Board and the Department of Public Health a group of men may be gathered, capable of carrying out at least a portion of the program which some of us have so ardently longed to see established, not only for the immediate benefit of the soldier, but also for the future of neurology through our increased knowledge of the disorders of the nervous system. When that time comes there will be less occasion for men with an old craniocerebral injury to wander, like Pte. A., into a doctor's study and ask if their country has treated them as fairly and understandingly as the men who lost their limbs in its service.

It is but human that the country shall tire of its wounded as a weary and harassed physician comes to tire of his patients, and as my hearers may doubtless become wearied of this abundant talk of Reconstruction. But what we, as physicians and former medical officers, must all set our faces toward is the greatest possible good which the country may derive from the lessons and experiences and indeed the mistakes of our corps during and after the war.

One very essential transfer of experience can take place between the treatment of war wounds and the treatment of industrial injuries which annually far outnumber our battle casualties. This has come to the minds of all, and mayhap a new profession for women, as important as the nursing profession, may arise through their valuable services as reconstruction aids.

We can all foresee many difficulties, even greater difficulties than confront us with our present problem, for victims of these injuries will be still more widely scattered among hospitals than our battle casualties have been. But this fact need not discourage us, particularly since, with all this demonstration of what may be done to rehabilitate our sick and wounded soldiers, the people and the nation are aroused, and private and governmental agencies will be more ready than ever before to aid the profession in its efforts to extend its activities—indeed will expect the profession to extend its activities beyond the hospital wards and operating room into a department of Civil

Reestablishment, if I may use the term of our Canadian friends for Reconstruction.

The medicine of our immediate forebears largely concerned the care of the individual when subject to injury or disease. Fine as the record may have been, we are going to see it eclipsed in the present century by two far greater movements that come before and after this period of hospital treatment. One of them is already well under way—preventive medicine, and the public health service; the other, the civil reestablishment on a large scale of the nation's sick and injured whereby they may be returned as part time participants at least in our industrial army. When medicine assumes this latter function on a large scale, we may properly come to attribute it to the example set by the Medical Corps of the Allied and our own armies to give the wounded soldiers of the past war their just dues.

CUTANEOUS SENSIBILITY IN CASES OF PERIPHERAL NERVE INJURY: EPICRITIC AND PROTOPATHIC HYPOTHESIS OF HEAD UNTENABLE

STANLEY COBB, M.D.

BOSTON

INTRODUCTION

Lack of standardization in the methods of examining sensibility in cases of peripheral nerve injury has led to diversity of results, and thereby to differences of opinion regarding the physiology of the peripheral nerves. Neurologists in different clinics often use totally different methods, and two men in the same hospital often get incompatible results in their sensory examinations of the same patient, because of apparently minor differences of technic. Another source of confusion lies in the terminology used to describe areas of anesthesia. A large part of this report is therefore devoted to reviewing the literature, in an attempt to gather from recent physiologic investigations facts applicable to the clinic. Too many workers have been willing to accept textbook interpretations of Head's work without reading the original papers themselves. Thus the popular conception of Head's theory has become more simplified, more attractive and farther from the facts, while the work of Boring, Trotter and Davies has received little attention.

REVIEW OF LITERATURE

The experimental investigation of cutaneous sensation began with the work of Head and his collaborators,¹ 1905-1908. Previous to this time, the skin had been studied merely by the introspective method, but the careful work of Goldscheider and Von Frey had discovered the main facts of the punctate distribution of end organs for each of the principal modalities—touch, pain, heat and cold. Barker² was the first to study an area of anesthesia by these methods, and his findings in an area of anesthesia on his own arm caused by a cervical rib, corroborated the physiologic findings of von Frey.

By having the sensory branch of his own radial nerve divided, Head brought out strikingly the fact that pressure was a subcutaneous sensation, and that light touch had to be very light in order not to elicit

* From the surgical service of Lieut.-Col. Charles H. Frazier, U. S. Army General Hospital No. 11.

1. Head and Rivers: *Brain* **31**:323, 1908.

2. Barker: *J. Exper. M.* **1**:348, 1896.

this underlying deep pressure. He carefully followed the return of sensation to his area of anesthesia for nearly two years, and from the data thus accumulated he evolved the theory of "epicritic" and "protopathic" sensibility.

"Epicritic" includes: (a) Recognition of light touch, as with cotton wool; (b) thermal sensations between 25 and 40 C.; (c) localization of cutaneous impressions; (d) discrimination of two points (compass test).

"Protopathic" includes: (a) Cutaneous pain of all kinds; (b) heat above 45 C.; (c) cold below 20 C.; (d) mechanical stimuli to hairs.

Head's general theory is well summed up by Boring³ in these two paragraphs:

Cutaneous sensibility is mediated by two afferent nervous systems which, from an evolutionary standpoint, are of different age. The older and more fundamental system is the protopathic; the later system, which represents a higher development, is the epicritic. Ordinarily, in most cutaneous experiences, the two systems act together. Under certain conditions, however, notably those following nerve-division, there may result a dissociation: after the division of a nerve the loss of "epicritic" sensibility is generally more widespread than the loss of "protopathic," so that there results a region supplied by protopathic sensation alone; but the relative distribution is not always of this kind, for there may occasionally appear areas which are supplied by "epicritic" sensibility alone. There is usually also a temporal dissociation: "protopathic" sensibility returns after nerve section before "epicritic," which usually does not begin to return until the return of "protopathic" is almost, or entirely, complete. Under normal conditions there is always a functional dissociation; for the internal organs and some other regions of the body, such as the glans penis, are supplied with "protopathic" but not with "epicritic" sensibility.

In the normal skin the two systems function together. Not only do they supplement one another, but there is also an inhibitory effect of the "epicritic" on the "protopathic" system. The latter naturally mediates intense sensations which are badly localized. The addition of the "epicritic," however, inhibits the bad localization of the "protopathic" and partially inhibits the intensity, besides adding its own complements to sensation.

This theory was accepted and taken up by the textbooks, gaining a hold that has scarcely been shaken by the more recent work, which has not only failed to corroborate it, but has pointed out the fallacy of the whole theory.

In 1909 and 1913, Trotter and Davies⁴ published papers describing repetitions of Head's work. Their experiments were more extensive, seven different nerves being divided and sutured in one or the other

3. Boring: *Quart. J. Exper. Physiol.* **10**:1, 1916.

4. Trotter and Davies: *J. Physiol.* **38**:134, 1909; *J. Psychiat. u. Neurol.* **20**:102, 1913.

of the authors. Their methods of examination were also better than Head's, since they were from the beginning able to benefit by his experience, and their critical analysis and repetition of his work seems fair and well founded. In general, they state that all forms of sensibility tend to reappear together after nerve division and suture, and that all returning sensation is at first hypoesthetic, gradually approaching normal sensitivity.

In the text of the paper, the statements are elaborate and direct. The idea that there are separate fiber systems for moderate (epi-critic) and for extreme (protopathic) perception was not borne out by the experimental facts, because when recognition of moderate degrees of temperature was lost, the extreme degrees were felt as moderate. That is to say, there was a thermal hypoesthesia, but not a loss of one or two hypothetical forms of sensibility to temperatures. Again in areas of tactile hypoesthesia the ability to discriminate two points was found diminished but not lost. So, too, with pain; it was found to return quantitatively, for at the very center of an hypoesthetic area, a heavier prick was necessary to cause pain than at the periphery. Finally, they state that Head's areas of dissociation merely represent varying grades of hypoesthesia, and that they doubt more and more the capacity of Head's hypothesis to generalize the facts.

In 1916 Boring³ published a monograph summarizing all previous work and reporting his findings in an area of anesthesia obtained on his own arm by cutting and suturing the anterior branch of the internal cutaneous nerve. Whereas the researches of Trotter and Davies were more extensive than Head's, Boring's were more intensive. He was a trained psychologist, and for thirteen months before the operation, he trained himself to recognize quantitative and qualitative values over the area that was to become anesthetic. Then after the operation most careful observations were made, with both qualitative and quantitative readings, for a period of over two years.

The results are clean cut, and in essentials corroborate and amplify the findings of Trotter and Davies. In general the abnormalities of all four modes of sensibility occur in the same region, but as regards the specific spots, there is no coincidence at all. Return of sensation is found to be gradual, from anesthesia through hypoesthesia to normal. It is not easy to state for a gradual recovery what the order of return of the modalities may be, but curves of the quantitative readings were made and it was found that pain appears to return to a normal state earlier, only because its return is more abrupt. In reality it reaches normality at about the same time as cold sense and touch (called "cutaneous pressure" by this author). The sensibility to warmth seems to lag behind somewhat.

In his criticisms of Head's hypothesis, Boring states that it stands in peculiar isolation with regard to the work of other investigators, that the evolutionary grounds for it are unique and invalid, and that the results of his own experiment do not bear it out. Neither he nor Trotter and Davies, found the dissociation of areas of epicritic and protopathic sensibility.

Thus careful experimental work is found to refute Head's hypothesis. A review of the clinical literature on peripheral nerve lesions will now demonstrate that it has been found unsatisfactory in that field also.

Dejerine and Mouzon⁵ found that in general the areas of anesthesia to brush or cotton tampon corresponded to those for pin prick. They therefore usually tested with prick alone, but occasionally amplified the examination with heat, cold, and vibration tests.

Tinel⁶ in his book on nerve wounds says:

Tactile, painful, and thermal sensibility should be studied in succession.

In reality, this minute examination is not usually necessary, for the areas of the three sensibilities are usually almost identical. It may at the same time be stated that thermal anesthesia is a little more widely diffused than painful anesthesia and the latter than tactile anesthesia.

But here again we are liable to an error of interpretation, for in the case of each sensibility we must distinguish the coarse sensation from the fine appreciation of the qualities of the sensation. This is the distinction, set up by Head between protopathic and epicritic sensibility; the vague sensation of touch is to be distinguished from the clear appreciation of the nature of the contact and of its precise localization; the rudimentary sensation of pain must be differentiated from the ability to distinguish the quality of the pain; the differentiation between hot and cold must be distinguished from an exact appreciation of moderate temperatures. There are so many special sensibilities, corresponding to terminal apparatuses, all the more complex because they supply more precise notions; in nerve sections they disappear with a rapidity proportional to their complexity and become regenerated all the more slowly as they correspond to apparatuses more highly differentiated.

Practically, in the case of peripheral nerves, we may generally dispense with these minute examinations.

Exploration with a pin alone supplies all necessary information.

The main fact gleaned from this quotation is certainly that in peripheral nerve lesions the areas of anesthesia for the various modes of cutaneous sense practically correspond, so that one test suffices for all. This is a practical refutation of Head's hypothesis, yet the author seems to accept the theory. His review of it is inaccurate in an essential point, for he says: "In the case of *each* sensibility we

5. Dejerine and Mouzon: *Presse méd.* 30: *ibid.* 31.

6. Tinel: *Nerve Wounds*, New York, William Wood & Co., 1917.

must distinguish the coarse sensation from the fine appreciation of the qualities of the sensation. This is the distinction set up by Head between protopathic and epicritic sensibility." A careful reading of Head's original paper shows that of the fundamental types of cutaneous sensation, one is classed as purely "epicritic" (light touch), one as purely "protopathic" (pain), and only the thermal senses have adaptations for appreciating both coarse sensation and the finer qualities. Mechanical stimulation of hairs might be considered the protopathic analogue of light touch. Localization and two-point discrimination would seem to result from the arrangement of tactile end-organs and are therefore not modalities of sensation. Thus it cannot be derived even from Head's papers that for each sense there are the two types of innervation, although his argument and discussion strongly suggest this conclusion. Indeed, as Trotter and Davies⁷ say, "Symmetry and the desire for classifications are apt to be mistaken for physiological principles."

The English clinicians are naturally even more prone to use the old classification. Souttar⁸ uses a camel's hair brush for "epicritic," and a pin for "protopathic," but states that in general the difference between the areas is negligible (p. 281). He also says that "deep sensibility may be elicited by moving the hairs whose roots are supplied by deep nerves." This statement seems untenable anatomically and physiologically; Head puts down hair sensibility as "protopathic" and therefore cutaneous, and Boring, Trotter and Davies consider it distinctly cutaneous.

Burrow and Carter⁹ made unusually careful observations in 1,000 cases of peripheral nerve injury. They state that a common mistake is the use of too coarse stimuli which appeal to deep sensation when intended to stimulate the more superficial sense organs. They used an ermine hair brush for "light touch," and a spring algometer for "pin prick." With a piece of cork on this algometer thresholds of deep pressure sense were recorded. Thus their stimuli were nicely standardized. "Sharpness" was considered a form of epicritic sensibility. Thermal sense was examined only in spinal cord cases.

Price, Feiss and Terhune¹⁰ state that a brush and pin were used to test touch and pain respectively, and that "almost always the areas of impairment to both touch and pain are for all practical purposes the same."

7. Trotter and Davies: *J. Psychiat. u. Neurol.* **20**:123, 1913.

8. Souttar: *Brit. J. Surg.* **6**:279 (October) 1918.

9. Burrow and Carter: *Brit. M. J.* **2**:535 (Nov. 16) 1918.

10. Price, Feiss, and Terhune: *Arch. Neurol. & Psychiat.* **1**:547 (May) 1919.

Stookey¹¹ goes into the question of skin sensibility in peripheral nerve injuries very thoroughly, and is the first clinician to state boldly that to continue in the use of the terms "epicritic" and "protopathic" appears misleading. He wisely advocates the use of the specific terms "cotton wool area," "pin prick area," etc. Temperature tests were carefully made with known degrees of heat and cold. It is to be regretted that the "cotton wool" and "pin prick" were not equally well standardized, for many charts are published showing interesting dissociations of sensation which really cannot be interpreted because they lack these quantitative data.

This short review of the literature at hand brings out one point clearly—that the investigator should have in mind the object of his work, whether it is clinical diagnosis or physiologic investigation. All sensibility study is in a sense physiologic, but the physiologist must pay special attention to the distribution of specific end-organs, whereas these may be ignored by the clinician since the necessary cooperation on the part of the patient is not to be expected and simpler methods give all the facts necessary for diagnosis. The methods are so different that any compromise is useless. In fact, all who have been interested in the end-organs of cutaneous sensation agree that it is impossible to obtain accurate accounts of sensory phenomena from clinical subjects. So convinced were they of this fact that they all finally cut their own nerves for observation of these phenomena. Clinical men, on the other hand, although they usually come down to simple practical methods, do not have the courage of their conviction that these simple methods are sufficient, and having read some of the physiologic papers, cannot help dabbling in the complicated technic. Thus they spend time accumulating data that are of doubtful clinical value, and that would not be acceptable as physiologic evidence.

EXPERIENCES IN U. S. ARMY GENERAL HOSPITAL, NO. 11

In this clinic approximately 540 cases of nerve injury have been examined in the six months ending April, 1919, and the patients operated on, sixty-six in number, have been repeatedly examined by the ward surgeons and the writer. At first areas of dissociation were searched for and found. When the area of protopathic loss was smaller than that of epicritic, or when there was epicritic loss alone, the findings suggested that sensation was returning, or that the lesion was incomplete. But as the method of examination improved, faith in these distinctions waned; and with the advent of standardized

11. Stookey: Surg., Gynec. & Obst. **23**:639 (Dec.) 1916.

algesiometers¹² and a standard method of examining for light touch¹³ no more areas of dissociation were discovered. For example, in a case of a recovering external popliteal lesion there was an oval area of disturbed sensation about 14 x 9 cm. When this area was examined with a needle prick of 30 gm., pain was everywhere felt, but when the pressure on the spring was reduced to 15 gm. the area of analgesia was found practically to correspond to that of tactile anesthesia. Thus a heavy prick elicits an area of dissociation and a light prick does not. If the usual method of testing with a pin held in the fingers had been used, the results would certainly have been variable and unsatisfactory.

Figure 1 shows a similar condition in a stationary lesion of the musculospiral nerve. But instead of finding no analgesia to the 30 gm. prick there is a smaller central area where even this strong stimulus is not felt. The lighter 15 gm. prick gives an area of analgesia practically corresponding to the anesthesia for light touch.

Figure 2, a musculospiral case with returning function, shows another common finding. The area for loss of pain to the 15 gm. needle prick is larger than the area where the brush is not felt, and the area for the 30 gm. prick is smaller. Thus we have three concentric areas, indicating that in these sensory examinations we are dealing with various grades of hypoaesthesia at the periphery, with anesthesia only at the center. Such findings would be impossible if there were two systems of cutaneous sensation which were either totally present or totally absent.

Figure 3 shows a similar condition in a case of complete division of the ulnar nerve, later checked up by operation. According to the older theories, the dissociation between the 30-gram-prick-line and the brush-line might have represented an area of returning sensation. Such examples could be repeated in large numbers. In fact, by vary-

12. The algesiometers used in this hospital were designed by Capt. S. D. Ingham. They consist of a sharp needle mounted on a spiral spring which plays back and forth in a brass tube the size of a small pencil. The compression of the spring can be regulated to make needle pricks of from 15 to 30 gm. pressure.

13. For "light touch" examination, a fine brush was employed, such as artists use for water colors. It was found necessary to pluck out about two thirds of the hairs, until the remaining pencil of hairs was so pliable that the skin could not be depressed by its application. Strokes with such a brush, at an angle to the surface of the skin, cannot elicit subcutaneous pressure sensations. Tampons of cotton wool, on the other hand, may become matted and exert enough pressure to stimulate subcutaneous end-organs. Such tampons are always too broad and clumsy to delimit accurately a small anesthetic area.

ing the quantitative values of the stimuli, dissociation of sensations can be predicted and produced almost at will. According to Trotter and Davies,⁴ if the exact locations of the pain spots are known, a prick of 1.5 gm. will elicit pain on normal skin, and very fine hairs will elicit touch sensation,¹⁴ but for practical purposes a soft brush that will not depress the skin may be used for cutaneous touch, or a needle of 15 gm. pressure for pain. These have been found by

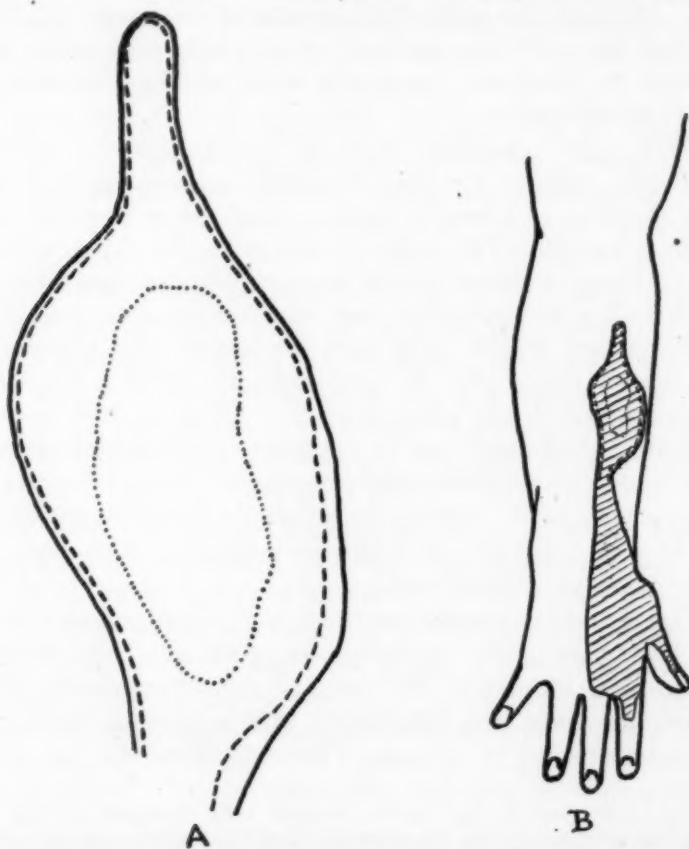


Fig. 1.—“A” represents a tracing ($\frac{3}{4}$ actual size) of the area of anesthesia of the patient mentioned in the text. The location of this area on the right forearm is indicated in “B.” The solid line is the boundary for the area of anesthesia for light touch with a brush; the broken line surrounds the area of analgesia for a needle prick of 15 gm., the dotted line for a needle prick of 30 gm.

experience to be practically equivalent stimuli; that is, they give almost co-extensive areas of anesthesia in any one case. As noted above, the same principle applies to thermal sense. It may be stated

14. Head and Rivers (Footnote 1); Trotter and Davies (Footnote 4).

therefore that "dissociations" of sensation in peripheral nerve lesions, arise from comparing stimuli not only qualitatively different but quantitatively unequivalent. In short, they are factitious because of lack of proper standardization of the methods of examination.

If these are the facts—and they seem to be proved by both experimental and clinical work—how should they affect the technic of examination? In the first place, it is obvious that some form of algometer should be used instead of a pin held in the hand. Also a standardized soft brush should be substituted for the tampon of cotton wool, and

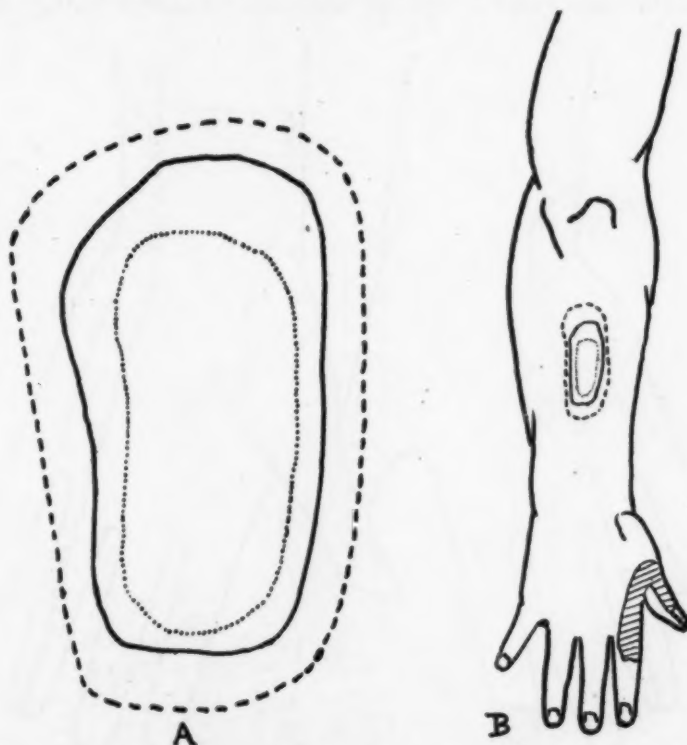


Fig. 2.—"A" and "B" represent a $\frac{1}{4}$ actual size tracing of the areas of anesthesia, and the location thereof, respectively. The symbols used are the same as in Figure 1.

known temperatures should supplant "hot" and "cold." In the second place, the fact that equivalent stimuli to different modalities of sensation give co-extensive areas of anesthesia makes it unnecessary to do more than one examination. But this one must be done carefully, and repeated with equal stimuli when later comparative examinations are made. Most clinicians use "pin prick"; Tinel,⁴ Dejerine and Mouzon,⁵ ask the patient to say whether the pin is felt as "touch" or "prick," thus outlining two zones. With cooperative patients this is

easy, but there are advantages in using the brush, for the patient merely has to answer "yes" quickly when he feels the stimulus.

It must be kept in mind that skin sensation is essentially punctate in distribution, so all methods that set out to find an area of anesthesia bounded by a sharp line are inaccurate. These boundary lines only indicate the average condition, showing nothing of the gradients between maximum and minimum sensitivity. "The method misrepresents a gradient by a line," as Boring puts it.⁵

In several cases pain has been brought out by a light needle prick well within the general area of analgesia. Careful testing showed

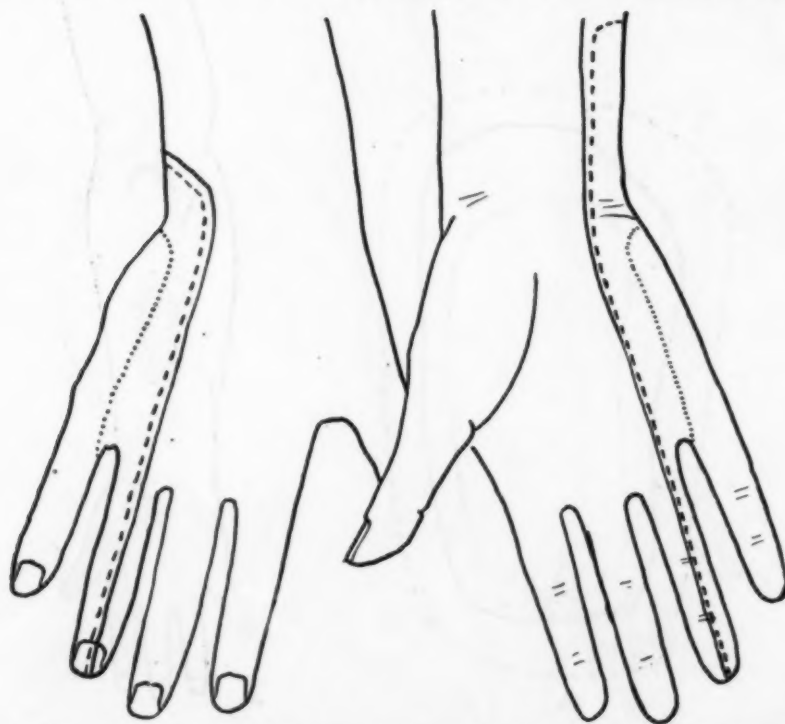


Fig. 3.—Areas of anesthesia as charted on a diagram of the hand. The solid line, broken line and dotted line represent the external boundaries of the areas of anesthesia for brush, 15-gram prick and 30-gram prick, respectively.

that these painful spots were usually along the course of a superficial vein. Trotter and Davies found that hyperalgesia persisted longer over such veins,¹⁶ than in other parts of the skin. This calls attention to the sympathetic system, and to the fact that some French authors have considered causalgia to be due to irritation of the sympathetic nerves.

15. Boring: *Quart. J. Exper. Physiol.* **10**:36, 1916.

16. Trotter and Davies (Footnote 4) Figure 7.

Possibly further investigation of the distribution of the hyperesthesia in patients with irritative lesions would be of interest in throwing light on this important subject.

In many peripheral nerve cases the paralyzed extremity is cold. Sensory examination on such extremities is unsatisfactory because the patient is not sure whether he really feels the tests or not, and gives variable answers which make it impossible to delimit sharply the area of anesthesia. In order to find out how important these varia-

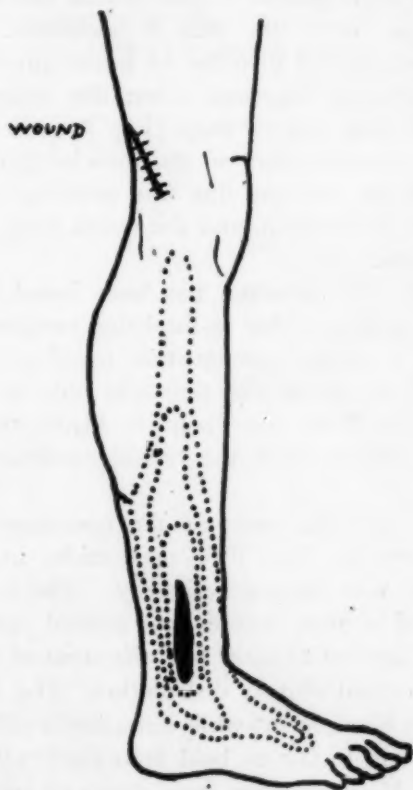


Fig. 4.—Diagram showing areas of anesthesia for varying grades of pressure. The solid black indicates anesthesia for 1,000 gm. pressure. From within outward, the next line shows the boundary of the area anesthetic to 800 gm.; the next, to 600 gm.; and the next, to 400 gm., as a contour map shows isometric altitudes. The case is one of complete interruption of the external popliteal nerve at the level of the head of the fibula.

tions might be several cases were examined, first with the extremity in its usual cold condition, and then after it had been warmed by immersion in hot water. Comparison of the results showed that the anesthetic area is larger when the hand is cold. In patients with

ulnar nerve lesions there was an error in the cold hand of from 0.5 cm. to 2 cm. and in the sciatics it even reached 5 cm. It therefore seems advisable to warm all cold extremities before examination. Burrow and Carter⁹ put the extremity to be examined into a paraffin bath and tested the skin while it was immersed in this liquid.

Subcutaneous pressure was tested with a spring instrument similar to the algesiometer, but with a blunt end about the size of a common pencil, and with a sliding scale on the side measuring pressures from 200 to 2,000 grams.¹⁷ Thus muscle and bone sensation can be tested in areas where the skin is anesthetic. The thresholds were recorded and charted in terms of grams pressure. Many such charts made interesting diagrams when the isometric points were joined by lines as in a contour map (Fig. 4). In general, the deep anesthesia seems to correspond to the muscles paralyzed, but much more work could be done in this line studying the anesthesia in relation to muscle innervation, and the overlapping of motor and of sensory innervations.

Vibratory and joint sensation has been found to be too grossly distributed to be of great value in localizing peripheral nerve lesions. A whole bone or a whole joint must be tested at once, and though the data obtained are interesting, they add little to the clinical diagnosis. Occasionally these tests help to distinguish an incomplete from a complete lesion, when the typical condition for a complete lesion is known.

Owing to the fact that most of the operations here have been done recently, there has been little opportunity to follow returning sensation in cases with known pathology. The experimental work reviewed above, of course, covered the general return of sensation, but it might be of interest to know how the areas of anesthesia usually receded for each typical sensory distribution. The fact that practical functional recovery often occurs while sensation is still largely impaired, makes it difficult and unfair to hold onto these patients. Stookey¹¹ and Dejerine and Mouzon⁵ show some charts of returning sensation; one median case was followed 281 days, but Head and Boring have found that the return is not complete after two years, even in small nerves.

CONCLUSIONS

1. A review of the experimental and clinical work on cutaneous sensibility indicates that the epicritic and protopathic hypothesis of Head and his collaborators should be abandoned.

17. This instrument was also designed by Captain Ingham and given to the writer to try out.

2. Dissociations of sensation due to peripheral nerve lesions arise from comparing stimuli not only qualitatively different but quantitatively unequivalent. In short, they are artefacts.

3. Clinical examinations should be simple, and since areas of dissociated sensation in peripheral nerve lesions are shown to be due to artefact, examination for one mode of sensation suffices for diagnosis.

4. For clinical sensory examinations quantitatively standardized stimuli should be used.

5. Subcutaneous pressure is best tested with an instrument which gives the threshold values in grams.

6. Hyperalgesia may follow the course of superficial veins.

SUPPLEMENTARY MUSCLE MOVEMENTS IN PERIPHERAL NERVE LESIONS

LEWIS J. POLLOCK, M.D.

Major, M. C., U. S. Army

CHICAGO

INTRODUCTION

The frequency with which more than one muscle may produce a similar movement of the segments about a joint emphasizes the necessity for the use of great care in the analysis of all muscle movements. This care is the more necessary in the study of peripheral nerve lesions because the muscles under consideration may receive their nerve supply from different sources.

The preservation of certain movements the loss of which is supposed to follow particular nerve lesions has been observed for many years. Sherren¹ called attention to the fact that Swan, in 1834, was astonished at how much a rabbit could move its leg after experimental section of its sciatic nerve. Later Letievant² studied this phenomenon and termed it supplementary motility. Since that time numerous investigators have observed its presence in peripheral nerve lesions. To Duchenne³ and Beavor⁴ we owe much of the present knowledge of these movements. Sherren, Head and Sherren,⁵ Claude,⁶ and Athanassio-Benisty⁷ are among the recent observers who noted its presence.

These movements may be caused by a number of factors. Among these may be included the anastomotic supply of muscles from adjacent nerves, movements produced by muscles other than primary movers in this action, movements occurring as the result of mechanical factors producing a change of direction of leverage by shortening and lengthening of tendons and muscles passing over several joints, and slight movements resulting from the recoil of elastic tissue following a movement in a direction opposite to the one desired.

1. Sherren: *The Lancet* **1**:727 (March 17) 1906.

2. Letievant: *Traites des sections nerveuses*, quoted by Sherren.

3. Duchenne: *Physiologie des mouvements*, Paris, 1867.

4. Beavor: *Croonian Lecture on Muscular Movements*, Adlar and Son, London, 1904.

5. Head and Sherren: *Brain* **28**: Pt. 2, 116, 1905.

6. Claude: *Revue Neurologie*, April-May, 1916.

7. Athanassio-Benisty: *Clinical Forms of Nerve Lesions and the Treatment and Repair of Nerve Lesions*, Military Medical Manual, London, 1918.

SUPPLEMENTARY MOVEMENTS IN MUSCULOSPIRAL LESIONS

It is ordinarily understood that when the musculospiral nerve is divided there is lost, extension of the first phalanges of the fingers, extension of the wrist and of the thumb, adduction and abduction of the hand, and if the lesion is high, supination of the forearms when extended and, rarely, extension of the forearm.

The prime movers for extension of the distal phalanx of the thumb are the extensor longus pollicis, the abductor and adductor pollicis and the flexor brevis pollicis. Therefore, although never as complete or as strong as when the extensor longus pollicis is spared, the other muscles may produce extension of the distal phalanx of the thumb (Benisty⁷) (Fig. 1).

A simulation of this movement may be produced by flexion of the distal phalanx of the thumb followed by relaxation. Such a mechanism



Fig. 1.—Extension of the distal phalanx of the thumb in musculospiral palsy.

is frequently observed in slight flexion of the fingers, in ulnar and median lesions, and flexion and extension of the toes in internal and external popliteal lesions, respectively.

If by abduction of the thumb is understood that movement which carries the thumb away from the first finger in a plane at right angles to the palm, then my observations agree with Beevor in that the extensor ossis metacarpi pollicis is a prime mover, along with the abductor pollicis, opponens pollicis and outer head of the flexor brevis pollicis. Although in musculospiral palsy the patient is unable to carry the thumb away from the first finger in a plane parallel to the palm, abduction is possible in a plane at right angles to the palm.

In a musculospiral palsy it is possible to tense the proximal phalanges of the fingers by extending the terminal phalanges; at the same

time flexion of the proximal ones occurs, as the result of the unopposed action of the lumbricales. Slight passive extension of the proximal phalanges may be produced by flexion of the hand at the wrist. Simulation of extension of the first phalanx of the index finger is frequently accomplished by strong adduction and opposition of the thumb against the first phalanx of the index finger, which is thereby passively lifted dorsally.

Normally, extension of the wrist is accomplished by the extensors carpi radialis and ulnaris, extensor longus pollicis, and sometimes by the extensor communis digitorum.

In a lesion of the musculospiral nerve below the elbow, paralysis of the extensors of the fingers may occur without involvement of the extensors of the wrist. Under these conditions the patient cannot extend the wrist if at the same time he attempts to extend the fingers,

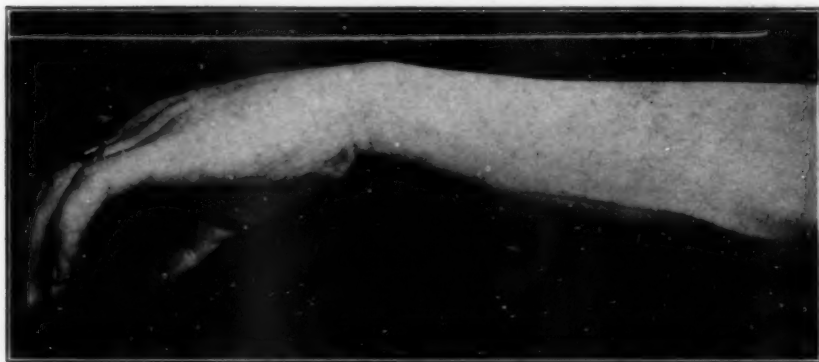


Fig. 2.—Wrist drop in musculospiral palsy.

but if he flexes the fingers extension of the wrist may then be accomplished (Duchenne³). To explain this we must recall the laws governing the action of muscles going over several joints. Beevor⁴ stated that "when a muscle by passing over two or more joints has two or more different actions, then if only one of these actions be required other muscles are brought into the movement whose actions are antagonistic to those of the muscles not required." These synergic muscles place the prime movers (in this instance being the extensors of the wrist) in the greatest elongation so as to augment their dynamic power and fix the joints so that the movements may be performed from a secure basis. Still another factor must be considered. Beevor has found that "if the movement of extending the wrist be performed with the fingers actively and fully extended, the extensors of the finger have to do all the work themselves and against the contraction of the flexors carpi

until the amount of work amounts to four or five pounds before the extensors carpi will join in and help them." In the cited instance of paralysis of the extensors of the fingers with preservation of the extensors of the wrist, the extensors of the fingers cannot possibly reach the amount of pull which is necessary before the extensors of the wrist can be made to contract.

In a lesion of the musculospiral nerve with paralysis of the extensors of the wrist dorsiflexion of the hand may be produced by the action of muscles not innervated by the musculospiral nerve. Dorsiflexion of the hand may occur in the course of energetic con-

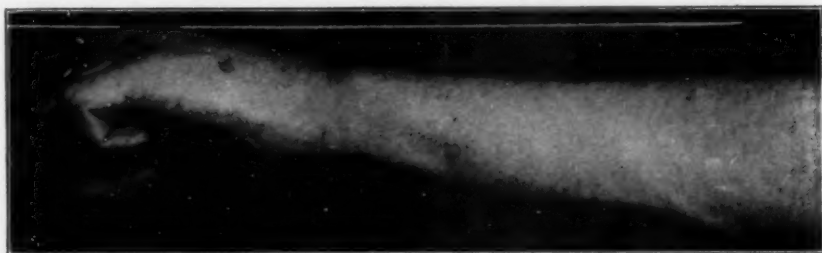


Fig. 3.—Passive extension of the wrist by flexion of the fingers.

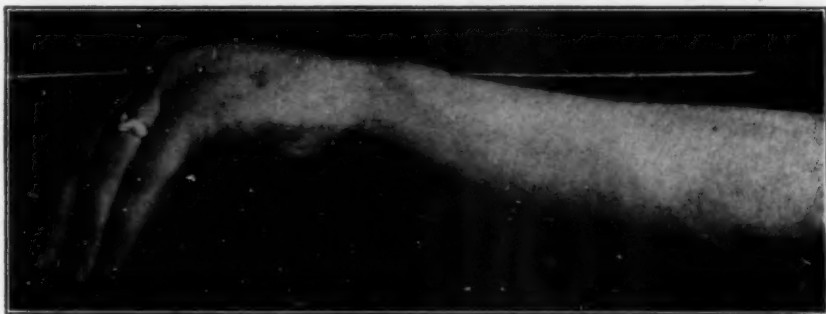


Fig. 4.—Passive extension of the wrist by strong contraction of the pronator radii teres.

traction of the flexors of the fingers. This occurs under certain conditions and has been noted frequently (Benisty⁷). When the wrist-drop does not exceed an angle of 120 degrees complete flexion of the fingers produces extension at the wrist. In this condition the extensors of the wrist are shortened by contracture and fibrosis so that the angle between the hand and forearm is such that passive dorsi flexion, or dorsal dislocation of the hand occurs when complete flexion of the fingers is accomplished. Without this provision the fingers could not be completely closed because of the shortened extensor tendons. The

mechanism may be illustrated by using the wrist as a hinge, the hand as the weight, the flexors as the power transmitted through a pulley at the metacarpophalangeal joint to a fixed point at the origin of the extensors of the wrist (Figs. 2 and 3).

In some cases strong contraction of the pronator radii teres will produce extension of the hand on the forearm. During this movement the head of the radius is strongly depressed toward the palm, the styloid process of the ulna is pulled dorsally and the hand is deviated to the ulnar side. It can be demonstrated readily that the hand can be flexed to a greater degree when the forearm is supinated

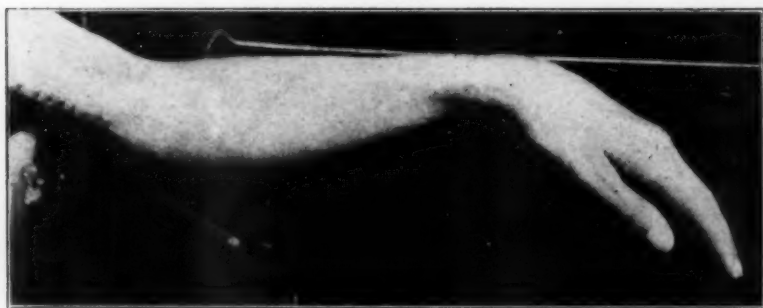


Fig. 5.—Wrist drop.

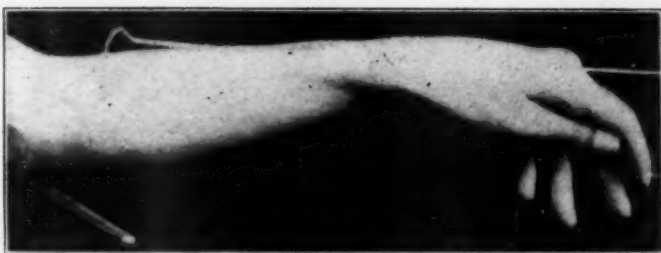


Fig. 6.—Passive extension of the wrist by adduction and opposition of the thumb against resistance of the index finger.

than pronated, and if flexed to its fullest degree when the forearm is supinated, the hand will be seen to extend when strong pronation is instituted. The extension at the wrist is probably due to two factors; first, lengthening of the extensor tendons and muscles, and second, to a leverage exerted on the scaphoid by the head of the radius (Figs. 2 and 4).

At times in addition to the contraction of the pronator, there is seen strong adduction and opposition of the thumb against the proximal phalanx of the index finger. At the same time resistance to this action

is made by the contraction of the lumbricale muscle, and the hand is extended on the forearm to a noticeable degree. During this action the middle, ring and little fingers show flexion at the proximal phalanx and extension of the two distal phalanges (Figs. 5 and 6). I have not found the last two mechanisms noted in literature.



Fig. 7.—Tensing of the flexors of the fingers when strong flexion of the proximal phalanges is performed.



Fig. 8.—Opposition of the thumb by the adductor pollicis and the flexor brevis pollicis.

Supination with the forearm extended is performed by the supinator brevis. The action of this muscle is superseded by the external rotators of the shoulder, chiefly the infraspinatus, which carry out a movement weakly suggestive of supination. With the forearm flexed

the biceps is the most powerful supinator and in musculospiral paralysis supination is unaffected in this position.

Although Duchenne⁸ contended that abduction and adduction of the wrist were performed by the extensors of the wrist alone, and Benisty⁷ stated that the action of the flexor carpi radialis as an abductor and of the flexor carpi ulnaris as an adductor is negligible, I believe, as does Beevor and also McKenzie,⁸ that for pure lateral movements the extensors and flexors are both necessary. Adduction and abduction of the wrist are superseded by pronation and supination of the forearm in the position of wrist-drop of a musculospiral palsy. If, however, the hand be passively extended to the same plane as that of



Fig. 9.—Extension of the distal phalanges of the index and middle fingers in ulnar palsy.

the forearm, adduction accompanied by flexion of the wrist ensues as the result of contraction of the flexor carpi ulnaris, but I have not observed abduction to take place under the same conditions.

MEDIAN NERVE LESIONS

In a division of the median nerve it is supposed that the patient is unable to pronate the forearm, to tense the palm, to contract the flexor carpi radialis, to flex the second phalanges of any finger, to flex the distal or third phalanges of the index and middle fingers, to flex

8. McKenzie: *The Action of Muscles*, New York, 1918.

the proximal phalanges of the index and middle fingers, to flex the second phalanx of the thumb, to oppose or abduct the thumb, to fully flex the proximal phalanx of the thumb.

Supplementary movements to pronation have been described by Benisty,⁷ such as holding the elbow outward in flexion of the forearm, and rotating the arm inward in extension of the forearm.

Contraction of the palmar muscles and flexor carpi radialis cannot be supplemented.

Normally, flexion of the proximal phalanges is accomplished by the action of the lumbricales; flexion of the second phalanges by the flexor sublimis digitorum, and of the terminal phalanges by the flexor



Fig. 10.—Adduction of the thumb by the extensor longus pollicis.

profundus digitorum. The flexor profundus digitorum for the two inner fingers, and the lumbricales for these fingers are supplied by the nerve.

Contrary to expectations, section of the median nerve frequently is followed by but little disturbance in the flexion of the proximal phalanges of the fingers. This seemingly paradoxical condition is due to a number of factors. Flexion of the proximal phalanges of the inner two fingers is preserved because the lumbricales of these two fingers are supplied by the ulnar nerve. The fact that the flexor profundus digitorum for the middle finger may in some instances receive its nerve supply from the ulnar, I think explains the frequent presence

of flexion of the first phalanx of that finger, inasmuch as the lumbricales have their origin in the tendon of the flexor profundus digitorum. If they are paralyzed, and especially if some contracture and shortening has taken place, contraction of the flexor profundus digitorum will produce a pull on the inert lumbricales and result in flexion of the proximal phalanx. That there is a pull exerted on the lumbricales seems to be shown by the fact that flexion of the first phalanx is stronger when combined with flexion of the terminal phalanges than when performed alone (Fig. 7). The lumbricale muscle for the middle finger likewise may receive its nerve supply from the ulnar. I am inclined to agree with McKenzie* that the lumbricales flex the proximal phalanges and the interossei extend the distal phalanges of the fingers, under normal conditions. But as was seen to be the case with the flexors of the finger producing an extension of the hand, so under



Fig. 11.—Abduction of the fingers by the extensor communis digitorum.

certain conditions the interossei may produce movements ordinarily subserved by the lumbricales. The interossei when extended produce a pull on the tendons of the flexors profundus and sublimis digitorum and when the lumbricales are paralyzed, especially if these are shortened, passive flexion of the proximal phalanges will occur. This mechanism permits full extension of the terminal phalanges, and in median nerve lesions occurs in the index and middle fingers. It is to be noted that despite the paralysis of the flexors in a median nerve lesion, the position of the fingers is one of flexion and not extension.

Flexion of the second phalanges of the inner two fingers occurs only a little weaker than normal as the result of the accompaniment of this movement to the normal flexion of the proximal and distal phalanges of these fingers. Flexion of the second phalanx of the middle

finger is frequently present in this general flexor movement. First, because it is influenced by flexion of the ring finger, and second, because the flexor sublimis digitorum for this finger in some instances must receive some of its nerve supply from the ulnar. Flexion of the terminal phalanx of the index finger is always absent. Flexion of the terminal phalanx of the middle finger may be present in those cases where the flexor profundus digitorum is supplied by the ulnar nerve.

Extension of the wrist produces slight passive flexion of the fingers which is better observed in combined lesions of the ulnar and median nerves.

Flexion of the terminal phalanx of the thumb may be simulated by the rebound following extension of this phalanx (Benisty⁷).



Fig. 12.—Abduction of the index finger by extension of the thumb and its metacarpal bone.

Opposition of the thumb may be simulated by the action of the adductor pollicis and the action of the adductor pollicis and the inner head of the flexor brevis pollicis, with the terminal phalanges of the finger being opposed, flexed (Fig. 8).

ULNAR NERVE LESIONS

Section of the ulnar nerve produces inability to flex the proximal or distal phalanges of the ring and little fingers, to abduct or adduct the fingers, to extend the second and distal phalanges of any of the fingers, to adduct the thumb, to contract the flexor carpi ulnaris, to abduct or oppose the little finger.

Flexion of the distal and proximal phalanges of the ring and little fingers is performed by the two inner tendons of the flexor profundus digitorum and the two inner lumbricales, respectively. The imperfect flexion of these phalanges is the result of influence exerted on all segments when the flexor sublimis digitorum contracts. This is more marked in the little than in the ring finger.

Slight flexion of the proximal phalanx of the ring finger may be obtained from the contraction of the flexor profundus digitorum pulling on the lumbricales muscles which has part of its origin from the tendon of the profundus.

Although the interossei which extend the second and third phalanges of all fingers are paralyzed, inability to extend these phalanges in the index and middle fingers is rare (Fig. 9). Benisty⁷ attributes this to the preservation of the lumbricales, which she states extend the second and third phalanges, as do the interossei. With this McKenzie disagrees,



Fig. 13.—Adduction of index finger by extensor indicis with hand in ulnar deviation.

and he is inclined to believe that the dorsal interossei for the index and middle fingers receive some of their nerve supply from the median. Beside this, he believes that with hyperextension of the proximal phalanx, there is an alteration in the line of pull of the interossei which become angular instead of straight, and that an extended proximal phalanx forms a rigid dorsal support for the sublimus tendon, thus increasing its flexion pull. Therefore, paralysis of the lumbricales alone would produce at one time overaction of flexion of the second phalanx and a poor mechanical principle for extension of the distal phalanges.

I have observed preservation of part of the first dorsal interosseus several days following a resection and suture of the ulnar nerve. This was demonstrated by a distinct bellying of the muscle accompanying the movement produced by its contraction. This leads me to believe

that there is a dual nerve supply for the first and second dorsal interossei. Other factors, however, enter into the production of extension of the second and third phalanges of the index and middle fingers. Duchenne,³ Benisty⁷ and McKenzie⁸ contend that the extensor communis digitorum does not produce extension of these phalanges. On the other hand, Beevor⁴ pointed out that although it was true that when the extensor digitorum was paralyzed the second and third phalanges could be extended, and when the interossei were paralyzed claw hand occurred and extension of the second and third phalanges was impossible, yet if in the latter case the first phalanges were passively flexed, the second and third phalanges could be extended. He says it is probable that in claw hand the inability of the extensor digitorum to extend the terminal phalanges is due to its energy being expended on the first phalanges which are not prevented from overextension by the

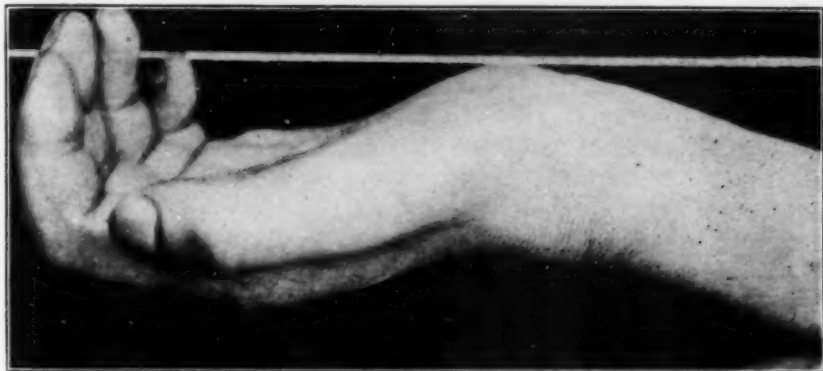


Fig. 14:—Position of wrist in combined ulnar and median lesion.

lumbricales which are paralyzed. I have been able to verify this in many cases of ulnar and combined ulnar and median nerve lesions.

The following factors enter into preservation of extension of the second and third phalanges: Innervation of the first and second dorsal interossei by the median, passive extension of the second and third phalanges by flexion of the proximal ones, thereby shortening the interossei. If the interossei are paralyzed and the lumbricales preserved, the pull on the interossei is straight and not angular; under these conditions, contraction of the extensor communis digitorum may exert a pull on the inert interossei and produce extension of the second and third phalanges. Some pull on the interossei may be exerted by the extensor communis digitorum even if these conditions are absent, as may be seen in combined ulnar and median nerve lesions.

The fact that the extensor communis digitorum exerts a pull on the inert interossei does not mean that it is at all concerned with the

normal extension of the second and third phalanges which may be the result of an entirely independent contraction of the interossei.

In adduction of the thumb, as pointed out by Duchenne,³ the extensor longus pollicis is a prime mover, and in ulnar nerve lesions it may supplant the loss of the adductor pollicis (Fig. 10).

Abduction of the fingers away from the midline may result from forced extension of the first phalanges (Fig. 11). It is very marked in the index and little fingers. Slight adduction results from flexion of the first phalanges. Both of these movements have been known for a long time. The reason for the preservation of lateral movements in the middle and index fingers is given by Benisty⁷ as the preservation of their lumbricales, as well as the extensor action of the first phalanges.

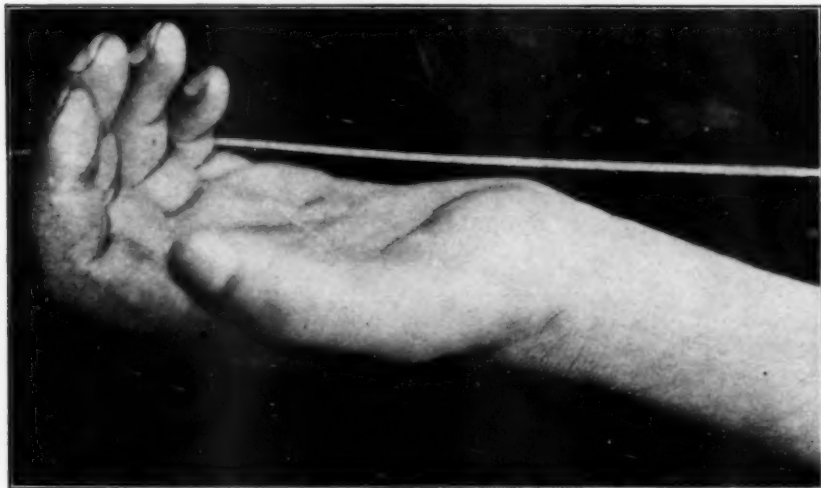


Fig. 15.—Flexion of the wrist by the extensor ossis metacarpi pollicis.

As McKenzie⁸ points out, the lumbricales are not concerned with lateral movements of the fingers. The preservation of lateral movements of these two fingers is due in addition to the extensor movements of the first phalanges, to a dual nerve supply, as it has been noted on a number of occasions that the first dorsal interosseus is partially preserved in complete ulnar section. Beside the abduction observed in forced extension of the first phalanx, abduction movement of the index finger can be produced by strong contraction of the extensor ossei metacarpi pollicis and extensor brevis pollicis; the first dorsal interosseus having part of its origin on the metacarpal bone of the thumb, is pulled onward by extension of this bone and produces abduction of the index finger (Fig. 12). When the hand is adducted to the ulnar side, the tendon of

the extensor indicis is so deflected that its contraction produces slight adduction of the index finger (Fig. 13).

In combined lesions of the ulnar nerves, Duchenne³ has pointed out that the extensor ossei metacarpi pollicis is a flexor of the wrist (Figs. 14 and 15).

SCIATIC NERVE LESIONS

In the lower extremity the principle supplementary movements have been observed in the toes as the result of rebound action following a movement in a direction opposite to the one intended.

In one case of a dissociated sciatic nerve lesion in which all the muscles supplied by this nerve with the exception of the flexors of the toes were paralyzed, strong flexion of the toes resulted in inversion and slight extension of the foot. The tibialis posticus was definitely paralyzed. This action was due to a mechanism similar to that observed in which strong flexion of the fingers produced passive extension of the hand musculospiral lesions.

MISLEADING MOTOR SYMPTOMS IN THE DIAGNOSIS OF NERVE WOUNDS *

ANDREW H. WOODS, M.D.

PHILADELPHIA

To the study of the neuromuscular system in peripheral nerve injuries, relatively insufficient thought is given, possibly because of the apparent crudeness of the problems involved. Yet in army hospital work we have found, in making decisions as to the operative and nonoperative treatment of nerve-wound patients, that motor symptoms have become our chief reliance. This is due to the fact that motor fibers are more vulnerable than sensory fibers, so that when mixed nerves are injured the earliest, and often the only, signs of trouble are presented by the motor fibers. Furthermore, from the patient's standpoint, motor defects are of much importance because of resulting disfigurement and inconvenience, and of the economic loss due to interference with work.

In dealing with peripheral nerve injuries the basal diagnostic fact on the motor side is that voluntary contractility in a muscle is proof that neural connection exists between it and its anterior horn centers. And, if disease of the muscle itself and of the corticospinal neurons need not be considered, the quality of the muscular contraction is a measure of the integrity of the motor nerve. If the opponens-pollicis, for instance, contracts poorly or not at all, we infer that the median nerve is proportionately damaged. In most cases these tests are easily applied and interpreted. But in gaging the condition of a nerve from the behavior of a muscle two causes of error are to be avoided: First, anomalous innervation occurs. If a given muscle is found to contract normally, we naturally expect to find its motor nerve uninjured. But several times in our experience the nerve which usually innervates the muscle in question has been found at operation completely severed, the motor axons to the muscle having reached it through another nerve. Some of the published cases in which function is said to have returned to a divided nerve immediately after suture are perhaps to be explained in this way: The nerve sutured was not the one that innervated the muscle under observation. Second, mistake is possible as to the fact of contraction in a muscle. The examiner supposes a certain muscle is contracting because of the movement in the limb which is ordinarily produced by that muscle. Closer inspection, how-

* Read before the Philadelphia Neurological Society, April 25, 1919.

ever, may reveal that the limb movement is being produced otherwise. In the diagnosis of nerve injuries in army hospitals these substitute movements were a prolific source of error. The following four classes of them are given as illustrations:

1. MOVEMENTS PRODUCED BY THE RESILIENCY OF NON-MUSCULAR TISSUES

When a muscle is normally innervated, a movement once willed proceeds from the original position of the joint continuously in the direction appropriate for that muscle. But when the patient tries to contract a paralyzed muscle, its antagonists being normal, he is apt to cause a preliminary contraction of the antagonists instead of the movement willed. Immediately following this momentary pull in the wrong direction, the joint is drawn back by the resilient soft tissues in the direction originally intended, just as if the paralyzed muscle had contracted. This phenomenon occurs oftenest in the interphalangeal



Fig. 1.—Musculospiral nerve severed. In the first picture the patient is trying to extend his wrist without flexing the fingers, but fails. In the second picture he has extended the wrist by flexing the fingers.

joints. To forestall the deception the joint should be held so as to prevent the contradictory movement of the antagonists, and the patient required to move the part from the start in the proper direction.

2. MOVEMENTS PRODUCED BY TENSION ON PARALYZED MUSCLES

When the tendon of a paralyzed muscle passes successively over two joints, the bending of either joint may place the dead muscle under tension and so cause the movement of the other joint which under normal conditions followed the contraction of the now paralyzed muscle. This was seen in our patients most often when there was paralysis of the long extensors of the digits (Figs. 1 and 2). When the fingers were strongly flexed, the extensor tendons were drawn over the knuckle joints and the whole extensor muscle put under tension. This pull on the unyielding muscle extended the wrist.

Dr. J. Ramsay Hunt¹ recently explained the extension of the wrist in a patient suffering from musculospiral paralysis as due to actual contraction of the extensor muscles. He assumed that this contraction was due, not to cortical impulses, but to impulses generated in the striate body and transmitted through hypothetical "paleokinetic" fibers that run in peripheral nerves and are able to struggle through obstructions that are impervious to ordinary motor fibers. In the "trick extension" described in the foregoing the extensor muscles of our patients were drawn palpably tighter, and the movement felt to the examining hand somewhat like a contraction; but the muscle-bellies did not show the characteristic shortening and bulging of an actual contraction. It seems possible that in Dr. Hunt's patient the extension may have been effected by the same mechanism as in ours.

The motor device under consideration was employed by patients in various other movements, such as extending the digits by actively flex-



Fig. 2.—Right musculospiral nerve severed; long extensor muscles paralyzed. In the first picture the patient is about to attempt extension of the wrists. In the second picture he has succeeded with the left hand without disturbing the fingers; with the right, only by flexing the fingers and strongly contracting the *opponens pollicis*. (Passive tension on long extensors of thumb and fingers.)

ing the wrist when the extensors were paralyzed; and under the same conditions in extending the terminal phalanx of the thumb by active contraction of the *opponens* and *abductor brevis pollicis* (Fig. 3), and in flexing the digits by active extension of the wrist, when the long finger flexors were paralyzed (Fig. 4).

To eliminate this deceptive factor when testing a particular muscle, it is necessary only to prevent the patient from putting that muscle under tension. For instance, in testing extension of the ankle the toes must not be flexed, since that would tighten the *extensor communis*

1. *Brain*, September, 1918, p. 302 et seq.

and tend to extend the ankle. This precaution having been observed, any extension of the ankle that occurs is due to the *tibialis anticus* or its adjuvants.

3. SUBSTITUTES FOR MOVEMENTS OF THE INTEROSSEI

(a) Many writers² maintain that the interossei alone extend the interphalangeal joints. As this movement would thus offer a delicate test for the condition of the ulnar nerve (which supplies the interossei), the question is of practical importance. Following the teaching referred to, a patient's ability to extend the middle and distal phalanges has been repeatedly taken by surgeons as evidence that an injured ulnar nerve was regenerating, in spite of other evidence to the contrary. We became convinced, however, that the interossei were not the sole extensors of these joints by finding at operation in four patients



Fig. 3.—Right musculospiral nerve severed; long extensor muscles paralyzed. First picture: Effort to extend terminal phalanx of each thumb without disturbing proximal phalanx. Second picture: Succeeds with left thumb; fails with right thumb, but finally extends terminal phalanx of right thumb by contracting flexor brevis pollicis and opponens pollicis. (Passive tension on extensor longus pollicis.)

who retained this motion that the ulnar nerve was severed. In these men, furthermore, after the ulnar nerve had been resected and sutured the power to extend the phalanges was still present; neither before nor after operation was there any movement referable to the interossei (Fig. 5).

The only muscles capable of functioning as extensors of the interphalangeal joints except those in the ulnar nerve distribution are the

2. Benisty, A.: *Clinical Forms of Nerve Lesions*, p. 32. MacKenzie, William C.: *The Action of Muscles*, p. 116.

extensors of the musculospiral system. It must therefore be true that the extensor communis digitorum, extensor indicis and extensor minimi digiti assist in this function, so that the presence of this movement does not necessarily indicate continuance or restoration of ulnar nerve control. Its absence, of course, shows that both ulnar and musculospiral nerves are blocked.

(b) *Lateral Finger Movements.*—The interossei adduct and abduct the fingers, and these movements are a useful index of the condition



Fig. 4.—Paralysis of muscles controlled by left median and ulnar nerves. First picture: Attempt to flex digits without disturbing wrists. Second picture: Succeeds in the right hand, but flexes the left digits only by extending the wrist. (Passive tension on long flexor tendons.)



Fig. 5.—After surgical resection of left ulnar nerve; paralysis of interossei. First picture: Metacarpophalangeal joints extended; inter-phalangeal joints flexed. Second picture: Contraction of long extensor muscles over-extends proximal phalanges, extends middle and distal phalanges.

of the ulnar nerve. Patients with ulnar nerve paralysis are, however, able to separate their fingers by extending them, because the direction of the pull of the long extensor tendons is such that it brings each phalanx into line with its metacarpal (Fig. 6). For this reason abduction and adduction should be tested with the metacarpophalangeal joints slightly flexed. A convenient test is to have the patient place his finger tips and wrist on a smooth surface. A coin is then placed

under the finger-tips one at a time, and the patient attempts to move it laterally. If he succeeds in doing this with each finger while the other fingers and the base of the hand are kept firmly in position, it is positive proof that the interossei are functioning.

4. ERRORS IN INTERPRETING MOVEMENTS OF PRONATION, SUPINATION AND FLEXION OF THE FOREARM

Pronation is ordinarily accomplished by the pronator teres and the pronator quadratus, innervated through the median nerve. Several of our patients with median nerve paralysis were, nevertheless, able to pronate by another device. The long wrist and finger extensors and the brachioradialis pursue a spiral course from the external condyle to or beyond the dorsum of the wrist. Contraction of this group therefore starts pronation and carries it half way. The patient then flexes his wrist and gravity carries the hand into complete pronation.



Fig. 6.—Ulnar nerve severed; interossei paralyzed. Patient is in the act of extending his fingers. The direction of the pull of the extensor tendons and the conformation of the surfaces of the metacarpophalangeal joints cause the fingers to separate.

Supination, if normally performed, shows that the musculospiral (supinator brevis muscle) and musculocutaneous (biceps muscle) are intact. The statement has been made that the biceps cannot aid in supination unless the elbow is partly flexed, and in one of our cases the question became of some importance. The patient had a serious musculospiral injury for which operation seemed advisable; but because he could supinate while the elbow was extended one surgeon counseled against operation, claiming that the supinators and the musculospiral nerve were acting. In this patient, also in several others with complete loss of musculospiral function, the findings at operation demonstrated that the biceps supinates the forearm even when completely extended.

Flexion of the elbow is dependent on the musculocutaneous (biceps and brachialis anticus) and musculospiral (brachioradialis). Yet one patient in our series with paralysis of both musculospiral and musculocutaneous nerves was able partly to flex his elbow, at the same time pronating it, by contracting his pronator teres. He had used the muscle so constantly in feeding and dressing himself that it was hypertrophied, and stood out conspicuously above the other forearm muscles.

THE EYE SYMPTOMS IN PSEUDOTUMOR CEREBRI, WITH REPORT OF AN ADDITIONAL OBSERVATION

RETROCESSION OF BILATERAL CHOKED DISK TO NORMAL; UNILATERAL
DEAFNESS FOLLOWED ONE YEAR LATER BY THE LOSS OF THE
VESTIBULAR FUNCTION AND THE UNILATERAL APPEAR-
ANCE OF THE ROMBERG SIGN

ANTON LUTZ, M.D.

HAVANA, CUBA

DEFINITION

By pseudotumor cerebri we understand a syndrome that presents all the cardinal symptoms of brain tumor, a syndrome which, in fact, does not admit of any other diagnosis, yet the consequent clinical course of the disease, whether it leads to improvement or to a cure, does not confirm the primary diagnosis. A certain number of necropsies following an operation or sudden death yielded entirely negative results, since no neoplasm in the brain could be found. In about ten cases certain alterations were found, but these were of so slight a nature that they could by no means explain the symptoms, and in three cases, even with the most exact microscopic examinations of the brain, no cause could be discovered for either the disease or its fatal termination.

HISTORY

Hughlings Jackson¹ published in 1876 a report of a case with all the symptoms of brain tumor and double choked disk, in which the necropsy gave an entirely negative result, since only a slight congestion of the brain was found. In 1891 Eichhorst² published an account of his observations which proved that meningitis serosa may produce the same symptoms as brain tumor. Byrom Bramwell³ published in 1899 "some cases of distended ventricles simulating a cerebral or cerebellar tumor," in which neither operation nor necropsy could detect a neoplasm. Wernicke observed the same symptoms in encephalomalacia, and the observation has since frequently been made by neurologists

1. Jackson, J. Hughlings: Royal London Ophthalmic Hospital Reports, 1876. 1876.

2. Eichhorst: Hydrocephalus internus idiopathicus bei Erwachsenen, Ztschr. f. klin. Med. 19: 1891, Supplement.

3. Bramwell, Byrom: On the Localization of the Intracranial Tumors, Brain 22:66, 1899.

and especially by brain surgeons (Krönlein, Küttner and others). This observation is all the more surprising for the reason that necropsies did not show an increase of the brain volume in proportion to the size of the cranial cavity. It is by this disproportion that the origin of the most outstanding symptoms of the brain tumor can be explained. Oppenheim, in 1901, called attention to the fact that great care should be taken in the diagnosis of brain tumor in children who present the general symptoms of this condition, but accompanied by signs referable to the motor cortical area. Nonne,⁴ who had especially observed and studied such cases, came, in 1904, to the following conclusions, based on eighteen observations: "There are clinical syndromes which, in the light of our present-day experience and limited knowledge, justify us in making the diagnosis of brain tumor, though the subsequent clinical course may show us that the diagnosis was wrong and retrospective reflection may not make clear to us the course of our diagnostic error. I refer to the cases which ended in a cure as well as to those followed by negative necropsies." Among Nonne's cases were found some in which the most exact microscopic, histologic and bacteriologic investigation failed to show anatomic alteration or infection. His observations were very soon followed by others, so that we have today about ninety cases in the literature. Mohamed Saleh⁵ gathered in 1912 all the cases published prior to that year. From his critical comparison most of the following statements are borrowed.

CLINICAL ASPECT

Mohamed Saleh discusses sixty-three cases reported in the literature and divides them into four clinical groups:

1. Symptoms of brain reaction without convulsions or signs of localization. (Ten cases with eight necropsies.)

All these patients presented headache, vomiting, vertigo, torpor cerebri, choked disk and ictus without convulsions. One case showed retardation of the pulse (30 beats a minute); two cases showed loss of weight. The deep and superficial reflexes were normal.

2. General symptoms with convulsions (fourteen cases with eight necropsies).

These cases showed epileptiform fits which were in some instances the first symptoms, and in others the last.

4. Nonne: Ueber Fälle vom Symptomenkomplex Tumor cerebri mit Ausgang in Heilung (Pseudotumor cerebri); über letal verlaufende Fälle von Pseudotumor cerebri mit Sektionsbefund, *Deutsch. Ztschr. f. Nervenhe.* **27**: 169, 1904.

5. Saleh, Mohamed: Etudes critiques des états dits: pseudotumeurs cérébrales, Thèse de Lyon, 1912.

3. General symptoms without epilepsy, but with signs of cortical localization (nineteen cases with seven necropsies).

These cases showed, besides intracranial hypertension, signs of unilateral cortical localization, such as monoplegia, hemiplegia, hemianopia, hemianesthesia, aphasia, alexia and ear ailments.

4. Cases with cerebellar symptoms (twenty-three cases, nine necropsies; three of the cases controlled during operation).

These cases showed asthenia, lateropulsion and cerebellar gait.

Pseudotumor shows no preference as to sex or age. Among the thirty cases collected by Mohamed Saleh in which necropsies failed to discover a neoplasm, there were fifteen men, thirteen women and two children. The youngest was 10 years old, and the oldest 79; but we may conclude that pseudotumor cerebri, like genuine brain tumor, is largely a disease of mature years, since only five out of thirty patients were under 20 years of age. Pseudotumor differs from genuine brain tumor in that the latter predominates in the male sex. Martin⁶ found in 513 cases of intracranial tumor 70 per cent. males and 30 per cent. females.

ANATOMIC FINDINGS

Necropsies were performed in thirty-two of Mohamed Saleh's cases. The alterations were in most cases minimal; in thirteen they were found almost inappreciable. Among the other nineteen there were found ten cases with hydrocephalus internus, four with encephalitis hemorrhagica, one with encephalomyelitis diffusa, one with meningitis chronica basalis, one with empyema ventriculare, and two with encephalomalacia. All of these cases had in common an abundant serous exudation in the brain with resultant increase of the intracranial pressure. Therefore, it may be assumed that the increased intracranial pressure, together with the toxinfection, produced the general as well as the local symptoms.

DIFFERENTIAL DIAGNOSIS

The diagnosis of pseudotumor cerebri can only be made with absolute certainty by a necropsy. We know from the thesis of Mohamed Saleh that many diseases are accompanied by the symptoms of brain tumor, and that some of these diseases have as yet an obscure symptomatology. The diagnostic difficulties arise in cases that result in a cure. In this connection the following data may be presented:

1. There are records of brain tumor discovered accidentally by necropsy which during life had not shown noticeable symptoms

6. Martin: The Localizing Value of Optic Neuritis in Intracranial Tumor, *Lancet* 2:81, 1897.

(Eichhorst). Thus, Byrom Bramwell reported a case in which a cerebellar tumor became encapsulated and, as a result, ceased to produce symptoms. Williamson and Roberts observed a myxoma of the cerebellum that had not shown symptoms during forty-six years. There are further records of benign tumors (psammomata, lipomata, cholesteatomata, aneurysmata, tuberculomata and echinococcus, in which the brain, after a state of intolerance, became accustomed to these growths. But these cases are very rare, and they show almost always residual symptoms, such as constant headache or epileptiform fits, even if all other symptoms disappear.

2. Hydrocephalus internus adultorum may be produced by all sorts of cachectic conditions. Eichhorst states that it can be found in pulmonary tuberculosis and chronic nephritis, as well as in saturnism or chlorotic anemia (Patrick⁷). It is of special importance that internal cachectic hydrocephalus can simulate, for instance in ventricular carcinoma, an apparent metastasis in the brain. Hydrocephalus internus is furthermore frequently produced by infection of the ependyma which may have its origin either in the external layer of the brain, as in purulent, tuberculous or syphilitic meningitis, or through the blood. Pierre Merle⁸ in his thesis has shown experimentally that acute infection of the ependyma gives the clinical aspect of meningitis, and that a chronic infection produces all the symptoms of a brain tumor. We must further remember that myxedema may produce in adults transient internal hydrocephalus which recedes on thyroid treatment, and that similar symptoms may be produced by pregnancy, likewise receding on its interruption. Nolen⁹ has observed an excellent example of this:

CASE 1.—A patient who fell ill during the second half of her twelfth pregnancy had headache, vomiting, torpor cerebri and hemiparesis of the right side. After the birth of the child all symptoms receded. The thirteenth pregnancy terminated in the fourth month without brain symptoms. In the third month of her fourteenth pregnancy she again fell ill, having the same brain symptoms as before, accompanied by bilateral choked disk and unilateral total reflex immobility of the pupil. A pulmonary infection made artificial abortion necessary. Several days later there appeared a left-sided ptosis and paralysis of the left internus; following this the symptoms slowly receded. Three years

7. Patrick: Brain Tumor Simulated by Anemia, *J. Nerv. & Ment. Dis.* 25:882, 1898.

8. Merle, Pierre: *Etudes sur les épendymites cérébrales*, Thèse de Paris, 1910.

9. Nolen: Ueber einen Fall von Pseudotumor cerebri, der im Verlauf einer Schwangerschaft auftritt u. in zwei folgenden Schwangerschaften recidiviert, *Berl. klin. Wchnschr.* Dec. 6 and 13, 1909.

later in the eight month of another pregnancy, the same symptoms appeared. Within two months after the birth of the fifteenth child all symptoms disappeared.

Nonne believes that in cases which result in recovery we can exclude internal hydrocephalus as the cause when the history does not show chronic alcoholism, physical or psychic trauma insolation, or tuberculous or syphilitic infection. A good example of the influence of a psychic trauma has been observed by Nonne:

CASE 2.—A young man, aged 30, who had always been healthy, suddenly heard that his wife had been crushed in a railway accident. He instantly fell ill, became weak and vomited. The following day he complained of headache, which became so violent that he went to the hospital. An examination revealed: pulse 36, pupils dilated without reaction and a bilateral choked disk. He died within a few days, and necropsy disclosed nothing beyond slight hyperemia of the ependyma and slight internal hydrocephalus.

Hoppe¹⁰ states that even then we cannot exclude hydrocephalus with certainty, because hydrocephalus may also be produced by other causes unknown to us. He reminds us that acquired hydrocephalus may occur from inflammation of the choroid plexus from pressure on the vena magna Galeni, or localized inflammation around the opening of the fourth ventricle.

So far as encephal meningitis is concerned, we can never be absolutely sure of the diagnosis, because we cannot rule out with certainty either localized tuberculous or localized syphilitic meningitis. We know by the observation of Eichhorst that tuberculous meningitis may heal either spontaneously or after lumbar puncture. Martin¹¹ cites twenty cases of healed tuberculous meningitis from the literature. We know by the observation of Rosenfeld¹² that nonsuppurative encephalitis may heal spontaneously.

Furthermore, we must remember also that serous meningitis may cause hemiplegia, aphasia and cerebellar ataxia, and that local symptoms are not always produced by local anatomic alterations. Quincke,¹³ who worked especially on serous meningitis, records that in the acute form fever may be absent, but that somnolence and rigidity of the neck are always present. He further says that the chronic form may have for years the aspect of a slowly growing brain tumor, showing nothing

10. Hoppe: Brain Tumor Symptom-Complex with Termination in Recovery, *J. Nerv. & Ment. Dis.* **34**:97, 1907.

11. Martin: The Occurrence of Remissions and Recovery in Tuberculous Meningitis; a Critical Review, *Brain* **32**:209, 1909.

12. Rosenfeld: Encephalitis der optischen Bahnen, *Centralbl. f. Nerven.* **28**: 1905.

13. Quincke: Ueber Meningitis serosa u. verwandte Zustände, *Deutsch. Ztschr. f. Nerven.* **9**: 1897.

more than headache, vertigo and alterations of character in the form of neurasthenia. Serous meningitis develops in most cases between the ages of 5 and 30. The younger the patient, the more acute is the form, and it generally follows an infectious disease like typhoid or pneumonia. The presence of choked disk argues more in favor of serous meningitis. Cushing and Bordley¹⁴ emphasized that meningitis of infectious origin very seldom conduces to choked disk.

PROGNOSIS

About half of the cases end in recovery. In some cases death comes very suddenly and necropsy furnishes no explanation. Some patients suffer one or more relapses. Of special ophthalmologic interest here are the cases of Hoppe, Higier, Finkelnburg, and Dor and Jaboulay, which showed recurrence after years of complete health, and in some of the cases three times, with a newly appearing choked disk. It is also remarkable that some patients die surprisingly soon after an exploratory operation.

THERAPY

It is obvious after the foregoing description that in any case showing symptoms of brain tumor we should follow the advice of Horsley, to treat the patient at least during six weeks with strong doses of iodine, and, if there are anamnestic indications, to use also mercury, arsenic, thyroid extract, etc.

It is further advisable to do a lumbar puncture, but it must be done with precaution. Trocme¹⁵ cites from the literature of the subject thirty-five cases in which death followed lumbar puncture. The precautions may be summed up in the following points: The patient should lie down for half an hour before the operation. The puncture should always be done with patient in a lateral position, the head being kept a little lower than the feet. The withdrawal of fluid should be made slowly and in not too large a quantity. It should be interrupted if the patient complains of increased headache or feels weaker. The patient should continue in a horizontal position for some time after the lumbar puncture has been completed. On the other hand, we call attention to the fact that Quincke has already pointed out the curative effect of the lumbar puncture in meningitis serosa.

As a second step, later on, craniectomy can be done, without incision of the dura. Thus, Henri Claude and F. Lejars¹⁶ made the

14. Cushing, H., and Bordley, J.: Observations on Choked Disk, *J. A. M. A.* **52**:353 (Jan. 30) 1909.

15. Trocme: De la thérapeutique palliative dans les tumeurs de l'encéphale, Thèse de Paris, 1909.

16. Claude, Henri, and Lejars, F.: Deux cas de méningite séreuse localisée de la région cérébelleuse et protuberantielle, *Société médicale des hôpitaux de Paris* **2**:817, 1913.

diagnosis of pseudotumor in two cases in which all the symptoms disappeared after craniectomy without incision of the dura. They mention that sometimes cysts of the arachnoid, produced by adhesive arachnoiditis or by a hemorrhage are found instead of true neoplasms. Such cysts are more easily discovered during operation than through necropsy, when the walls rupture during the opening of the skull. Similar cysts over the convexity of the brain have been found by Wendel,¹⁷ Zesas,¹⁸ Bachelier¹⁹ and Mehmed.²⁰ They have been found in the cerebellopontile angle by Placzek and Krause,²¹ Unger²² and Finkelstein²³ and Alfred Murray.^{23a} Sicard holds that in any case we can make the diagnosis of pseudotumor, if the symptoms definitely recede after palliative craniectomy, because numerous statistics show that palliative operation cannot prolong a patient's life longer than eighteen months in true neoplasm of the brain.

EYE SYMPTOMS

In the presence of headache, vomiting and vertigo, the diagnosis of brain tumor is chiefly made on the appearance of choked disk. It may therefore be advisable to give a brief summary of the eye symptoms in cases of pseudotumor cerebri.

A. CASES CONTROLLED BY NECROPSY

If we accept as positive cases of pseudotumor cerebri only those in which necropsy failed to reveal neoplasm in the brain, we would have to consider thirty-two cases mentioned in the thesis of Mohamed Saleh. To these we may add two cases mentioned in the paper of Byrom Bramwell; the case of Hughlings-Jackson; two cases of Williamson and Roberts,²⁴ who found, out of one hundred cases of

17. Wendel: Ueber Meningitis serosa circumscripta cerebri, Arch. f. klin. Chir., 1912.

18. Zesas: Ueber Meningitis serosa externa circumscripta cerebri, Samml. klin. Vortr. auf d. Gebiete d. Chir., 1913, No. 188.

19. Bachelier: La meningite séreuse circonscrite de la corticalité cérébrale, Thèse de Lyon, 1913.

20. Mehmed: Sitzung der Herzte des Gulhane Krankenhauses in Konstantinopel, 1913, Deutsch. med. Wchnschr., 1914, p. 576.

21. Placzek and Krause: Zur Kenntnis der umschriebenen Arachnitis adhesiva cerebri, Berl. klin. Wchnschr. 22: (July) 1907.

22. Unger: Ein operierter Fall v. Arachnitis circumscripta syphilitica der hinteren Schädelgrube, Berl. klin. Wchnschr. Feb. 1, 1909.

23. Finkelstein: Russk. Vrach., 1908.

23a. Murray, Alfred: A Case of Bilateral Choked Disk Produced by a Cyst of the Cerebello-Pontine Angle; Successfully Operated on: Restoration of Vision, Ophth. Rec. 20:245, 1911.

24. Williamson and Roberts: Remarks on the Diagnosis and Prognosis in 100 Cases of Double Optic Neuritis with Headache, Lancet 1:1350, 1900.

double optic neuritis with headaches, two instances of slight internal hydrocephalus; further, one case each of Diller;²⁵ Riggs;²⁶ Gowers, Kupferberg,²⁷ and Engelhard;²⁸ Pouseppe²⁹ records three cases with negative necropsy, but the reference that was at my disposal was too brief.

Out of these forty-six cases, confirmed by necropsy, forty-three, whose history I was able to read, showed:

1: Choked disk in varying degree.

(a) Present in thirty cases: Of these, twenty-eight were bilateral; namely, nine cases of Nonne;³⁰ one case each of Hoppe, Long,³¹ Sicard,³² Reichhardt,³³ Schroeder,³⁴ Vincent, Marinesco,³⁵ Ramsay Hunt,³⁶ Rosenfeld, Weber and Schultz,³⁷ Hughlings-Jackson, Diller, Riggs, Gowers, Kupferberg, Engelhardt; two cases of Byrom Bramwell and of Williamson and Roberts, and one case of Finkelnburg and Eschbaum,³⁸ which showed postneuritic optic atrophy in both eyes without restriction of the visual field as residuum of the choked disk. In two cases the choked disk was unilateral (cases of Nonne and Devic-Saleh).

25. Diller: A Case of Serous Meningitis Simulating Brain Tumor, *J. Nerv. & Ment. Dis.* **25**:441, 1898.

26. Riggs: Symptoms Simulating Brain Tumor Due to the Obliteration of the Longitudinal, Lateral and Occipital Sinus, *J. Nerv. & Ment. Dis.* **34**:260, 1907.

27. Kupferberg: *Deutsch. Ztschr. f. Nervenh.*, 1893.

28. Engelhard: Neuritis Optica bei Chlorosis; Krankheitsverlauf u. Tod unter den Symptomen eines Hirntumors, *Münch. med. Wchnschr.*, 1900, p. 1233.

29. Pouseppe: *Russian Rev. of Neurol.*, 1913; abstr. *Rev. neurol.*, 1914.

30. Nonne: Beiträge z. Frage v. Pseudotumor cerebri, *Deutsch. Ztschr. f. Nervenh.* **27**:169, 1904; *Deutsch. Ztschr. f. Nervenh.* **33**:317, 1909; *Neurol. Centralbl.*, p. 961, 1907. *Differentialdiagnose des Tumor cerebri*, *Neurol. Centralbl.*, July 15, 1912.

31. Long: Transactions of the Société de neurologie, *Rev. neurol.*, Jan. 12, 1911.

32. Sicard: Transactions of the Société de neurologie, *Rev. neurol.*, Jan. 12, 1911.

33. Reichhardt: Entstehung der Hirndrucksymptome, *Deutsch. Ztschr. f. Nervenh.*, p. 339, 1905.

34. Schroeder: *Hospitaltid.*, June 16, 1909.

35. Marinesco: Deux cas de pseudo-tumeur cérébrale: meningite séreuse et hydrocephalie acquise, *Nouv. iconog. de la Salpêtrière*, p. 47, 1911.

36. Hunt, Ramsay: The Chronic Progressive Softening of the Brain; Report of Cases with Autopsies Simulating Cerebral Tumor, *New York Neurol Soc.*, May 1, 1906; *J. Nerv. & Ment. Dis.* **33**:779, 1906.

37. Weber and Schultz: Fälle v. Pseudotumor cerebri mit anatomischer Untersuchung, *Monatschr. f. Psychiat. u. Neurol.* **23**:212, 1908, Supplement.

38. Finkelnburg and Eschbaum: Zur Kenntnis des sogenannten Pseudotumor cerebri mit anatomischem Befunde, *Deutsch. Ztschr. f. Nervenh.* **38**:35, 1909.

In one case of Nonne, the choked disk has followed in three weeks by total blindness; in others (Riggs and Engelhardt) it led to amaurosis in a few months.

In three cases the choked disk disappeared and the fundus recovered normal aspect; in the cases of Rosenfeld the choked disk healed within two months, leaving no trace. In the case of Hoppe, the choked disk disappeared, in the first attack, within six months; the patient had a recurring choked disk seven years later, which disappeared a second time within six weeks, with no other treatment than potassium iodid. In the case of Higier³⁹ the fundus twice recovered normal aspect, and the choked disk reappeared for a third time many years later.

(b) Choked disk was absent in eight instances: Vorkastner⁴⁰ and Henneberg,⁴¹ two cases each; one each of Hochhaus,⁴² Bonnhoeffer,⁴³ Ramsay Hunt and Boetticher.⁴⁴

(c) In the remaining four cases fundus examination was apparently not made.

This gives in at least 75 per cent. of the cases, choked disk; whereas true tumor shows it in from 80 to 90 per cent.

2. One case of Nonne was complicated with homonymous hemianopsia; the case of Gowers, with bitemporal hemianopsia.

3. Motility of the eye:

(a) The exterior musculature of the eyeball showed different anomalies. In five cases nystagmus was present (Sicard, Schroeder, Byrom Bramwell, Nonne, Finkelnburg); in two cases ptosis was observed: Rosenfeld and Knauer;⁴⁵ in three cases conjugated deviation of the eyes was present (two cases of Nonne, and one of Bonnhoeffer); eight cases showed diplopia, and this was produced in six cases by paresis of one or both abducens (Bramwell, Kupferberg, Schroeder, Marinesco, Vincent, Sicard).

(b) The interior eye musculature showed: in four cases, loss of pupillary reaction (three cases of Nonne and one of Kupferberg); the

39. Higier: *Neurol Centralbl.*, 1910.

40. Vorkastner: *Einige praktische Winke in der Behandlung nervöser Erkrankungen*, Berl. klin. Wchnschr., p. 759, 1905.

41. Henneberg: *Fehldiagnose in operativ behandelten Fällen v. Jackson'scher Epilepsie unbekannten Ursprunges*, Charité-Ann., p. 314, 1905.

42. Hochhaus: *Ueber Hirnerkrankungen mit tötlichem Ausgange ohne anatomischen Befund*, Deutsch. med. Wchnschr., p. 1657, 1908.

43. Bonnhoeffer: *Bedeutung der Jackson'schen Epilepsie für die lokalisationistische Diagnose*, Berl. klin. Wchnschr., p. 935, 1906.

44. Boetticher: *Aerztlicher Verein Hamburg*, Deutsch. med. Wchnschr., 1905, pp. 1909 and 1989.

45. Rosenfeld and Knauer: *Stoffwechselstörung in einem Fall v. Pseudotumor cerebri*, *Neurol. Centralbl.*, 1907, p. 636.

pupillary reaction was not altered in the others, which showed: one, miosis (Henneberg); seven, marked mydriasis, and four, anisocoria.

4. One case was complicated by exophthalmia: Alquier;⁴⁶ one case by dyschromatopsia (probably congenital red-green blindness): Devic-Saleh.

5. Five cases showed alterations in the ear; the loss of hearing was bilateral in four cases (two cases of Nonne, one case each of Vincent and Saleh), and unilateral in one (Finkelnburg).

The comparison of these forty-six cases, controlled by necropsy, shows us that choked disk, mydriasis, nystagmus and paralysis of the abducens, are the most constant eye symptoms in pseudotumor cerebri.

B. CASES NOT CONTROLLED BY NECROPSY

Mohamed Saleh has further collected in his thesis thirty-four cases of pseudotumor cerebri which were not confirmed by necropsy but which, after a critical study of the descriptions, he considers as bona fide cases; they all had been under observation for more than two years after the disease set in. To these cases of Mohamed Saleh we may further add the following as probable cases of pseudotumor cerebri, although not confirmed by necropsy: One case of Oppenheim,⁴⁷ healed within a year and a half after lumbar puncture; three cases of Babinski and Chaillous,⁴⁸ healed after lumbar puncture; one case of Dor and Jaboulay⁴⁹ observed for eight years; one case of J. N. Roy,⁵⁰ healed after lumbar puncture, and finally the case of Alfred J. Horsey.^{50a}

Considering these cases from an ophthalmologic standpoint, we find as a most important fact that all eye symptoms disappeared with the cure of the disease. There were found: nystagmus in seven cases; paralysis of the abducens in seven; keratitis neuroparalytica in one (Finkelstein); paralysis of the oculomotor in three; exophthalmia in one (Finkelnburg); ptosis in one (Nolen).

Ear ailments were noted in various cases; unilateral deafness appeared in a case of Finkelnburg and the deafness developed as a rule one or two years after the disease set in; only in one case of Nonne did deafness appear as first symptom.

46. Alquier: Sur le diagnostique des tumeurs de la protuberance annulaire, *Gaz. d. hôp.*, 1911, p. 873.

47. Oppenheim: *Gesell. f. inn. Med.*, Berlin, Nov. 15, 1897.

48. Babinski and Chaillous: Ponction lombaire dans les nevrites optiques d'origine intracrânienne, *Ann. d'ocul.*, July, 1907.

49. Dor and Jaboulay: *Gaz. hebdomadaire de médecine et de chirurgie de Lyon*, 1902, No. 44.

50. Roy, J. N.: *Annales des maladies de l'oreille, du larynx, du nez et du pharynx*, 1912, p. 1.

50a. Horsey: Case simulating tumor of the brain in which there was present headache, vomiting and optic neuritis; remarks, *Ophth. Rec.* 6:636, 1897.

Choked disk was found present in thirty cases, and of these, one was unilateral (Finkelnburg). It was absent in five cases, and in one fundus examination apparently was not made. Of these thirty cases with choked disk, two were followed by complete amaurosis: Finkelnburg and one case Merle;⁵¹ eleven healed with defective vision; sixteen cases receded so completely that neither ophthalmoscopic nor visual examination could detect a trace of the former disease. Under these sixteen cases were found: seven of Nonne; four of Finkelnburg and Eschbaum; one each of Nolen, Velter,⁵² Claude and Baudouin,⁵³ and Unger. In the case of Unger the patient had been nearly blind and recovered normal vision after incision of a serous cyst in the cerebellopontile angle. In the case of Roy the patient was completely blind during two days, and had shown a marked bilateral nervous deafness without alterations of the vestibular function (the Bárány test with hot water remained negative). He recovered, within six weeks, his normal vision and hearing.

In all the cases choked disk appeared as the last symptom of the brain tumor syndrome, and likewise always disappeared last. Finkelnburg and Eschbaum observed in three cases recurrences of choked disk; in one case choked disk disappeared within six months; reappeared two years later, and the patient returned again to normal vision within six months. In another case relapse occurred ten years after the first attack; this patient likewise going back to normal. In a third case, the relapse occurred four years after the first attack, normal vision returned within three months, and choked disk reappeared a third time two years later, normal vision returning likewise after this recurrence. In the case of Dor and Jaboulay, all symptoms, including bilateral choked disk, disappeared after lumbar puncture; the patient suffered a relapse seven years later, with reappearing choked disk, which again disappeared after palliative craniectomy had been done.

From the foregoing comparisons, we may conclude that although retrocession of choked disk in genuine brain tumor is an exceedingly rare occurrence, it occurs rather frequently in pseudotumor cerebri, and consequently we may regard spontaneous retrocession of choked disk as a symptom strongly indicating pseudotumor cerebri. There

51. Raymond François Merle: Deux cas de pseudo-tumeurs cérébrales, *Rev. neurol.* 17:1522, 1909.

52. Velter and Chauvet: Deux cas d' hypertension intracrânienne sans tumeur cérébrale guéris par la craniectomie décompressive, *Rev. neurol.* 1911, p. 269.

53. Claude and Baudouin: Un cas de pseudotumeur cérébrale, *Rev. neurol.* 1911, p. 122.

are other articles in the literature describing retrocession of choked disk; namely, those of Gunn, Yamaguchi, de Schweinitz;⁵⁴ Anderson⁵⁵ with three attacks of reappearing choked disk; Jacobsohn;⁵⁶ Gowers⁵⁷ and Park.⁵⁸ I do not know whether, in these cases, necropsy disclosed the presence or absence of a neoplasm. They are strongly suspected of being cases of pseudotumor.

If the choked disk and other eye symptoms disappear, not spontaneously but after lumbar puncture, we are still not certain of the absence of brain tumor. Flatau⁵⁹ saw choked disk recede to normal after four lumbar punctures. The patient had a relapse three months later and died, the necropsy disclosing a gliosarcoma of the cerebellum. Babinski and Chaillous⁶⁰ observed retrocession after seven lumbar punctures had been made. Necropsy two years later proved the presence of a tumor. Other observations of retrocession of choked disk following lumbar puncture have been made in patients suffering from brain tumor symptoms, by Schneyder,⁶¹ Donath,⁶² Fraenkl,⁶³ Schuster.⁶⁴ But all these cases were under observation only for a few months, and it is, therefore, impossible to classify them definitely. I do not know if there exists a reliable observation of a retrocession of choked disk to normal, in real brain tumor, retrocession being observed at least three years.

On the other hand, it should be remembered that lumbar puncture is often without effect on choked disk as well as on the other brain tumor symptoms. Schneyder and Pérol⁶⁵ each observed two cases, in all of which lumbar puncture had no influence. We may, therefore, conclude, with Babinski and Chaillous and with Lapersonne, that negative influence of lumbar puncture as well as of palliative craniectomy, speaks always in favor of real brain tumor.

54. DeSchweinitz. *Arch. Opth.* **24**:252, 1895.

55. Anderson: *Opth. Rev.*, 1886.

56. Jacobsohn: *Arch. f. Psych.*, 1896.

57. Gowers: *Med. Ophthalmoscopy*.

58. Park: *Ann. of Otol.*, 1895.

59. Flatau: *Ueber die Rückbildung der Stauungspapille bei Hirntumor*, München. med. Wchnschr., 1905, p. 646.

60. Babinski and Chaillous: *Craniectomie décompressive dans les nevrites optiques d'origine intracrânienne*, *Ann. d'ocul.*, 1908, p. 55.

61. Schneyder: *La ponction lombaire comme thérapeutique palliative dans les tumeurs de l'encéphale*, Thèse de Bordeaux, 1908.

62. Donath: *Wien. med. Wchnschr.*, 1903, p. 2306.

63. Fraenkel: *Berl. klin. Wchnschr.*, 1895.

64. Schuster: *Ophthal. Klin.*, 1901, p. 60.

65. Pérol: *La céphalée dans les tumeurs de l'encéphale*, Thèse de Paris, 1907.

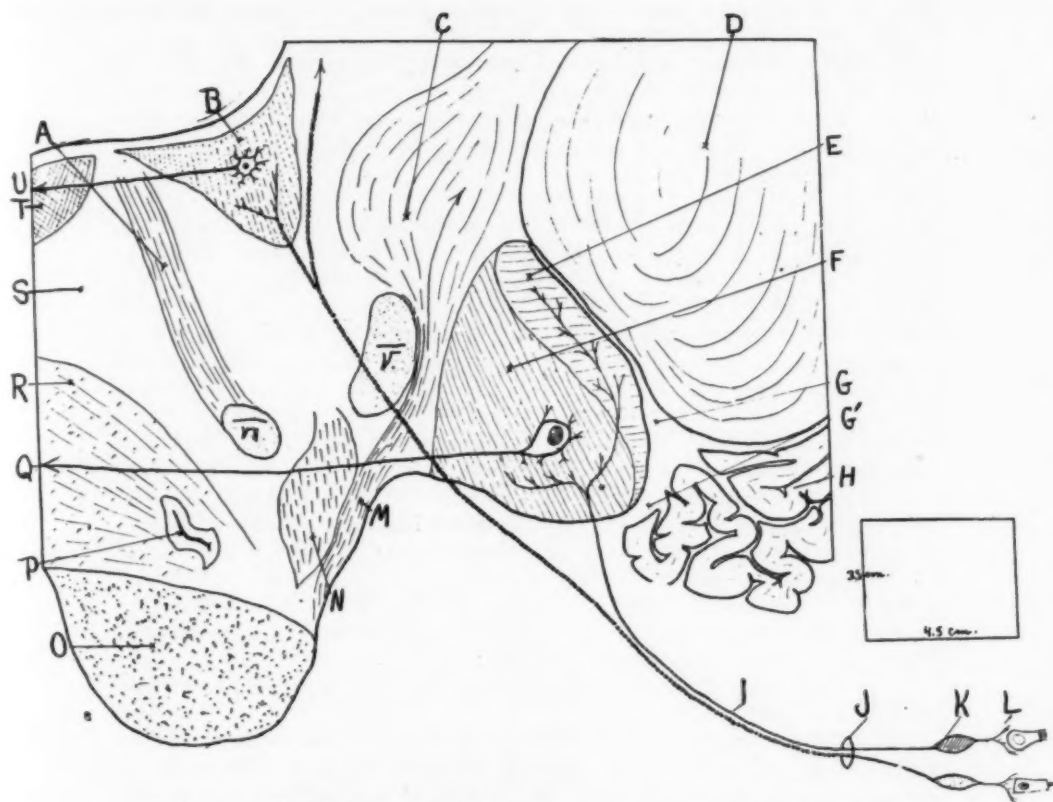


Diagram in illustration of semeiologic references: *A* signifies pars ascendens facialis; *B*, nucleus vestibularis (Deiteri); *C*, corpus restiforme (sensus profundus insciens); *D*, brachium pontis; *E*, tuberculum acusticum; *F*, nucleus cochlearis (sensoric pontine center); *G* and *G'*, angelus cerebellopontinus; *H*, flocculus cerebelli; *I*, nervus acusticus; *J*, porus acusticus internus; *K*, ganglion spirale; *L*, ganglion Scarpae; *M*, fasciculus spinocerebellaris (muscular sense, homolateral); *N*, fasciculus, sensus temperaturae et doloris (heterolateral); *O*, pyramis; *P*, oliva inferior; *Q*, central auditory path passing through the lemniscus lateralis of the other side to the corpus geniculatum internum; *R*, lemniscus sensitivus medialis (sensus conscius superficialis et profundus); *S*, formatio reticularis; *T* and *U*, via vestibularis passing through the opposite longitudinalis pontilis to the bulbar nuclei. The rectangle at the margin of the diagram indicates the approximate natural size of the section which is 3.5 by 4.5 cm.

PERSONAL OBSERVATION

CASE 2.—Aug. 2, 1916, I saw for the first time the patient, B. L. T., aged 34. She was married for the second time, and stated that her first husband had died six years before from pulmonary tuberculosis. The family physician informed me that he had treated him for syphilis.

She had had by her first husband one child (still living), she had suffered one abortion in the fourth month, and one child had been born dead. By her second husband she had one living child. She stated that for three months she had had swollen glands in the left groin, with fistula; that two months previously she had begun to suffer from headaches which increased in intensity every day. For one month she had had vomiting and vertigo; the vomiting having been so violent that she could no longer eat anything, and the vertigo so excessive that she could not leave home; that it was impossible for her to use street cars as she always had the feeling that the car went up and down like a ship over the waves, and that the houses on both sides were inclined and threatened to fall on her head; that the vertigo had always a longitudinal character, never rotary or circulatory; that her sufferings had been so very intense that she had been forced to stay in bed for several days at a time. Examination revealed: Vision: right eye, 1/0; left eye, 0/5; accommodation, normal. Visual field: There was a very slight restriction of the color fields; but there were no central scotomata. Pupils: The right pupil was narrower than the left. The reaction of both was normal to direct and indirect light on convergence and trigeminal irritation. Fundus: In both eyes there was marked choked disk with hemorrhages; the difference of refraction between border and top of the disk being in the right eye 4 diopters, in the left, 2 diopters. Motility: Constant diplopia in all directions by paresis of both abducens nerves (or contraction of the interni); no nystagmus. Urine: No albumin or sugar was present.

In the right groin a gland developed to the size of an egg; in the left one a fistula was found.

The sensorium was completely free; she had had no fever; there was no Kernig's sign; no rigidity of the neck. Pressure on the mastoid process was very painful, especially on the left side. Headache was localized in the posterior part of the head, in the neck and in the shoulders. She complained of always hearing noises and acute whistles. It was very difficult for her to stand or to walk; therefore a slight astasia existed, but it was not possible to verify a lesion of the pyramids, nor to ascertain whether a lesion of the superficial or profound sensibility was present. One of her neighbors stated that she suffered painful attacks every day, during which she remained quite rigid, could not bend her neck; her gaze would become fixed, sometimes the eyes converged and sometimes the right arm shook.

August 6: Attack of severe pains and involuntary contraction of both arms; the muscles of the breast, neck and shoulders appeared rigid, there was found a slight trismus; she complained of pains in the left side of face and breast; she felt as though her lips and breast were swollen; eye and facial muscles were normal; there was paresthesia in the right arm and in the right leg, and doubtless hypalgesia in the right arm.

August 8: There were paresthesias in both hands and arms; hypesthesias in the left trigeminal field, and bad taste always present in the mouth.

August 10: I had an opportunity of observing an attack which began with paresthesia in both hands; slight nystagmus; trembling in the left forearm and

left hand, and in the right thumb; rigidity of the neck and slight contraction of the left facialis. When standing, she fell toward the right side and backward.

August 15: The pupils were much enlarged. The reaction was normal. There were pains all over the left side of the body, and trembling of the left arm and left leg.

August 16: The blood Wassermann reaction was positive; the patient having the feeling that she might die any moment.

August 20: For two days the patient felt very much better.

August 25: Vomiting disappeared; she had no more diplopia, but headaches continued.

September 1: She had no more paresthesias; she could walk steadily again.

September 8: The patient felt completely normal; she felt well and had gained 19 pounds in weight. The eyes were entirely normal. The vision was 1/0 in both eyes. Choked disk had disappeared without leaving a trace.

During the whole period the patient had no other treatment than a strong dose of iodine.

Aug. 20, 1918: I again saw the patient, two years after the last attack. She stated that one year before (August, 1917), she had had quite a similar attack, but far less severe, for about eight days, with headaches, vertigo and vomiting. She complained that she did not hear so well as before, and especially not with the left ear, and that from time to time she fell toward the left side without being able to explain the reason for falling. Otherwise she felt very well, and had increased 48 pounds in weight. An ophthalmologic examination showed absolutely normal sight for long and short distances. Pupillary reaction, fundus aspect and visual field were absolutely normal. She had no more diplopia. An examination of the ear showed that the function of the acusticus was lost on the left side, without alterations of the function of the vestibularis. The exact report of Prof. Emilio Martinez, to whose courtesy I owe the otologic examinations, was: "The patient has lost the bone conduction in the left ear. The vestibular apparatus is not destroyed, as the patient shows horizontal nystagmus on the turning test." A general examination of the nervous system by Dr. José Valdés Anciano did not show signs of spinal or cerebral disease. It was noteworthy that there were no signs of cerebellar affection. Sensibility and motility were found normal, there was no ataxia, no adiadokokinesis, no asynergia, and no dysmetria. It was on this occasion that Dr. Valdés Anciano induced me to study the interesting thesis of Mohamed Saleh.

September 20: The right pupil was narrower than the left; reactions were normal. Her daughter told me that her memory had begun to fail, and that from time to time she had crying spells without any cause, but that these spells had no spastic character.

Jan. 8, 1919: During recent months she had had no more ictus, but she had had from time to time again slight tremblings over her left hand and left leg, and slight vertigo in longitudinal direction. Combing was very painful for her. In the past four weeks she had lost 10 pounds and felt again severe pains in the left arm and cardiac region with palpitations which lasted sometimes for a few minutes, and at others, for hours. Anisocoria had disappeared, pupils were normal as well as fundi and visual fields.

January 12: The blood Wassermann reaction was strongly positive, in the same manner as two years before. An examination of the blood and of the spinal fluid, which I owe to the courtesy of Dr. Martinez Dominguez and

Dr. Palma, gave the following result: Blood count: red corpuscles, 4,000,000; leukocytes, 11,000; hemoglobin, 70 per cent. There was no hyperglobulia, no abnormal cells and no signs of a destructive process. Spinal fluid: The fluid rushes out under pressure and in a quantity far more than normal. The fluid is clear and does not contain sugar. The total albumin content is 0.7 per thousand. The examination of the fluid revealed:

(a) For syphilis, negative; absolutely negative Wassermann test; (acid butyric test absolutely negative Noguchi-Moor).

(b) For tuberculosis: There was no lymphocytosis and no Fehling's reduction.

(c) For meningitis suppurativa, negative; cultures in Loeffler's serum, blood-agar and glucose-broth remain sterile. Reactions of Pandy, Piralta, Gangui, Violeta and collargol were negative.

There appeared a slight meningeal reaction with marked hyperproduction of the spinal fluid, but without any signs of tuberculosis, syphilis or tumor.

January 24: After a slight quarrel in the family the patient suffered a fresh attack which I had occasion to observe. Sensorium was not lost, although she could not speak. She indicated by nodding her head that she had understood my questions, and executed all the movements I asked of her. She kept the eyes closed; the pupils were of equal size. She could open the mouth only with difficulty. She always lay on her left side, her back curved. Sensibility was diminished on the whole left side, and its transmission was retarded. The tendon reflexes were diminished, the left leg was found in spastic extension and the left arm was found completely paralyzed. The musculature of the face was in constant motion. From time to time she felt intense pains in the left side; the pulse was accelerated to 120 per minute; the neck became stiff, the left leg more extended, the left arm rotated outward and fell with the contracted fist over the left side of the neck and finally over the region of the heart, as if the worst pains were located there. This status lasted about three hours. Later on she felt again quite normal.

April 27, 1919, I saw the patient again. For the past two months she had taken no more potassium iodid. She had been working of late from eight to ten hours a day in preparation for the wedding of her daughter. She felt perfectly well, though she had lost 16 pounds more. She has a good appetite and complains only that from time to time she suffers from vomiting in the morning before she has eaten anything. She has no more headache nor vertigo nor ictus. She suffers rather frequently from palpitation of the heart and states that for the slightest cause or for no cause she bursts out crying. Also her memory has failed somewhat.

An objective examination does not show any signs of tabes. The Argyll Robertson pupil and the Westphal sign are absent. Conscious profound sensibility is normal (diapason). There are no signs of cerebellar affection; no nystagmus can be observed, neither spontaneous nor the form that accompanies voluntary movements; no adiadokocinesis; no tremor and no ataxia. The tendon reflexes are not exaggerated and are on both sides normal. Muscular strength on both sides is good and equal. Her gait is firm and normal. The sensibility is normal and equal on both sides for touch and she localizes well the position of her extremities with closed eyes. The sensation of pain is equal, but perhaps a little under normal on both sides. The sensation of pain is somewhat retarded on the right side of the body (except the face) and does not persist so long as on the left side. The patient contended half an hour after this examination that I certainly must have used the needle with

greater force on her left side than on her right. The sensation of cold (10 C.) is equal on both sides; but she does not feel so well the heat (50 C.) on the right side of the body (except the face). This is especially marked in the right leg, where she confounds almost always hot and cold and where she can distinguish cold only after a remarkably long time.

With eyes closed she shows some unsteadiness of gait. This slight Romberg sign remains the same when she stands on the right leg putting the left heel to the right knee; but she is unable to stand, with closed eyes, on her left leg. The staggering sensation becomes immediately so strong that she falls to the floor, but she can stand well on the left leg with the eyes open.

Her eyes show a slight anisocoria, the right pupil being a little larger than the left, but without any alterations of the pupillary reactions. Fundus and visual examination were normal; there was no diplopia; conjunctival and corneal reflex were present. There were no signs of the trigeminus, facialis or glossopharyngeus being affected. The otologic examination by Prof. Emilio Martinez shows the following conditions:

AD	—	8 m	2.2 m	5/60	0.5 m	9"	8"	12"	C
	R	V	v	H	P	CoM	C ² A	C ² A	LI
AS	o	om	om	o/60	om	o"	o"	o"	o

The vestibular apparatus of both ears was tested by cold water. The left side was completely insensible and revealed no nystagmus. On the right side nystagmus was present, followed by intense vertigo. Conclusion:

Right ear: slight chronic catarrhal deafness (O M C C).

Left ear: complete destruction of acoustic and vestibular functions.

To summarize: The patient shows now abolition of the left acusticus and the left vestibular functions, slight anisocoria without alteration of the pupillary reactions, slight diminution of pain and temperature sensation on the right side of the body and loss of the unconscious muscular sense on the left side of the body.

EPICRISIS

In view of the foregoing described symptoms, we have to consider:

1. *A Malignant Tumor.*—One could willingly believe that the first violent attack was produced by a hemorrhage of one of the vessels of a tumor at the time when it was still very small; but the presence of a malignant tumor (sarcoma or glioma) is improvable because:

(a) From the time standpoint it is not likely that a malignant tumor would produce only such slight symptoms, considering that since the first attack at least three years had elapsed.

(b) There is the contraindication that the patient had gained subsequently forty-eight pounds.

(c) There is a lack of a marked alteration of the blood picture.

2. *A Benign Tumor.*—One might be inclined to believe that the brain became accustomed to a slowly growing benign tumor, but as opposed to this hypothesis we must remember:

(a) That the butyric acid test of the spinal fluid was negative.

(b) That the patient did not show signs of increasing paralysis, but mostly signs of irritation, and that these signs of irritation appeared

at times also on the right side, though they were found mostly on the left.

The best explanation, perhaps, would allow a benign tumor of the left cerebellopontile angle. We know that this originates generally from the sheaths of the acusticus facialis, or trigeminus; that they produce unilateral symptoms and that they act not by infiltration, but by pressure on the region, because they are mostly encapsulated fibrosarcomata or endotheliomata. But against the acceptance of this explanation bear in mind that the patient showed also symptoms of the right side, and that adjacent symptoms were lacking from the trigeminus, abducens and facialis, the symptoms corresponding more to an irregular irritation of the cranial nerves. We must also consider that the glossopharyngeus showed almost no symptoms, nor did the nervus Wrisbergi, and that for some time the vestibular function of the left side was not altered notwithstanding the fact that the function of the acusticus was lost. Brissaud⁶⁶ records an interesting observation which he made of a tumor of the cerebellum which destroyed, by pressure, the radix cochlearis of one side, leaving intact the radix interna (vestibularis). The radix cochlearis is covered and stands in intimate relation to the pia mater. It can therefore easily be destroyed by any process of the arachnoid, while the radix vestibularis is well protected by the corpus restiforme. The fact that our patient did not show cerebellar symptoms cannot be considered as conclusive evidence against the diagnosis of cerebellar tumor, as we know from recent war experiences that unilateral lesions of the cerebellum may be present without symptoms.⁶⁷ But against a cerebellar tumor lies the fact that the patient gained many pounds in weight after the first attack, and that doubtless cerebellar symptoms, especially spontaneous nystagmus, did not develop during the following three years. It remains, therefore, more probable that we are concerned with a cyst of the arachnoid produced by arachnoiditis adhaesiva, which provoked by pressure the irritation of the roots of the various cranial nerves and destroyed the radix cochlearis; provoked the pains, the asthenia, and the falling to the homolateral side by pressure on the left corpus restiforme (bundles passing from the spinal cord and from Deiters' nucleus to the cerebellum). Against the assumption of a tumor of the cerebellopontile angle we must consider the sudden onset of the disease with choked disk; the fact that all symptoms disappeared rapidly, and that disturbance of hearing did not appear until two years after the first attack. As a rule, tumors of the cerebellopontile angle begin with dis-

66. Brissaud: *Le syndrome cérébelleux, Maladies nerveuses*, 1:565, 1895.

67. Holmes, Gordon: *The Symptoms of Acute Cerebellar Injuries from Gun-Shot Wounds, Brain*, 40:461, 1917.

turbances of the ear, and show only in the later stages of the disease symptoms of intracranial hypertension with choked disk. Regarding our previous experience with pseudotumor, we may state that, as a rule, deafness developed some months after the beginning of the disease.

Furthermore, it is of especial interest to note that the patient presented complete unilateral deafness for more than one year, although the homolateral vestibular function was not abolished. This fact weighs strongly in favor of the assumption that the cause is not a tumor that originated in the sheaths of the acusticus. Henschen found, from a study of 136 cases in the literature, that the tumors of the acusticus originate, as a rule, at the junction of the ramus vestibularis and the acusticus within the porus acusticus internus, which explains why such tumors usually destroy both rami at the same time and why paralysis of the facialis (entering also the porus acusticus internus) follows so soon. There are very few cases reported in the literature showing suppression of the acoustic function without lesion of the vestibular function or vice versa. Eagleton⁶⁸ records that in labyrinthitis serosa the auditory portion of the labyrinth shows greater resistance and that we find, therefore, preservation of hearing after complete loss of the vestibular function. Thomas and Egger⁶⁹ made the same observation in a case of cerebellar tumor. The anatomic investigation showed a complete destruction of the nucleus vestibularis and only slight alterations in the nucleus cochlearis. The somewhat complex topographic relations of the cerebellopontile angle will be borne in mind in the following summary:

SUMMARY

A personal observation of my own shows just the opposite relationship from that of Brissaud, namely, unilateral loss of hearing without loss of vestibular function. This can be explained only by pressure at the edge of the cerebellopontile angle. In the case of Roy there was bilateral nervous incomplete deafness, although an examination of the vestibular apparatus could not detect any abnormality. In his case the deafness was certainly caused by serous meningitis. In our case we might diagnose a cerebellar tumor; but against such diagnosis speaks strongly the lack of spontaneous nystagmus. Eagleton emphasizes the fact that spontaneous nystagmus is apt to be a late manifestation of tumors originating in the cerebellopontile angle, in contradic-

68. Eagleton, Wells P.: The Importance of Aural Symptoms in the Early Diagnosis of Tumor of the Cerebellopontile Angle, *J. A. M. A.* **68**:333 (Feb. 3) 1917.

69. Thomas and Egger: *Compt. rend. Soc. de biol.*, 1902, p. 735.

tion to tumors originating in the cerebellopontile angle, in contradiction to tumors growing into it from the cerebellum (involving the cerebellar cortex).

It is noteworthy, furthermore, that the patient showed only slight staggering, with closed eyes, when she stood on both legs or on the right one, but that this staggering became very marked if she tried to stand on the left leg alone, although, with the eyes open, she could stand easily on the left leg. The patient presented, therefore, a unilateral pure Romberg sign through abolition of the homolateral fasciculus spinocerebellaris (unconscious muscular balance). This unilateral Romberg sign is in agreement with the fact that temperature sense and pain sense were slightly diminished on the contralateral side.

The combined symptoms show that an alteration of the meninges in the whole cerebellopotomedullar angle has destroyed the nucleus cochlearis, the radix pontina vestibularis, and the adjacent tractus spinocerebellaris.

The patient has lost her ictus, she now walks firmly and no longer falls down. This fact cannot be explained by the mere statement that the nervous vestibularis is now completely destroyed and that no cause of further irritation exists. To explain it adequately, we must accept the fact that the loss of the vestibular function has been compensated for by a better development of the voluntary muscular sense which accompanies the peripheral sensibility to the cortex, meanwhile the involuntary muscular sense is transmuted by a separate bundle to the cerebellum. This assumption is based on the experiments of Ewald (*Physiologische Untersuchungen über das Endorgan des Nervus octavus*: Wiesbaden, 1892); Ewald cut the nervus vestibularis unilaterally in dogs; after a time normal disequilibrium was completely restored; but by destruction of the sensori motor zone of the cortex Ewald was able to make reappear in their whole intensity all the symptoms of loss of equilibrium in such dogs.

(c) Against the assumption of either a malignant or a benign tumor is the retrocession of the choked disk to normal. Kampherstein saw this in 200 cases only once. It is doubtless an exceedingly rare occurrence in true brain tumor. We have seen before that it occurs quite commonly in pseudotumor. Kornder⁷⁰ has shown that the development of choked disk is dependent on a combination of two factors: increased intracranial pressure and increased venous pressure. It was Graefe's⁷¹ first opinion that choked disk was produced by compression

70. Kornder, L. H.: Hydrocephalus and Choked Disk in Dogs, *Arch. Int. Med.* **23**:197 (Feb.) 1919.

71. Graefe: Ueber Complication von Sehnerventzündung mit Gehirnkrankheiten, *Arch. f. Ophthal.*, Part 2, **7**:58, 1860.

of the sinus cavernosus, causing a stasis in the ophthalmic veins. That this explanation is wrong was proved: (1) By the anatomic investigation of Seseman (1868) who demonstrated the free anastomosis between ophthalmic and facialis veins; (2) by the exceedingly rare occurrence of choked disk in cases of sinus thrombosis, and (3) by the experimental ligature of both venae jugulares (Cushing). On the other hand, Schieck (1910) showed that a mere rise of the intracranial pressure is insufficient to produce choked disk, and that an increase of cerebrospinal fluid is essential. He produced artificial brain tumor by sponge tents under the skull and by the injection of paraffin through the dura; these alone did not cause choked disk. Kornder produced choked disk experimentally in dogs: once by blocking the aquaeductus Sylvii through injection of paraffin, where it appeared on the third day following; another time by intradural injection of liquids under pressure. If, in these cases, he avoided the rise of the venous pressure by the administration of atropin, he prevented the formation of the choked disk. He thinks it therefore probable that an irritation of the inhibitory vagus center produces the rise of the venous pressure followed by an increased secretion of the cerebrospinal fluid. If we apply these experimental observations to our case, we find in the lumbar puncture an increase of spinal fluid. If, however, the choked disk has disappeared, we may conclude that there does not exist a constant rise of the intracranial pressure and consequently no neoplasm.

Jumentié⁷² records in his thesis that hydrocephalus internus adultorum, meningitis serosa, and even tumors of the frontal brain, may produce absolutely the same symptoms as tumors of the cerebello-pontile angle.

3. *A Syphilitic Process.*—Opposed to this conception, these facts may be urged:

(a) The whole clinical feature: though the patient's husband was treated for syphilis, and though her blood Wassermann reaction was found repeatedly strongly positive, she herself had never had symptoms of syphilis during her life. Syphilomata are found, as a rule, at the base of the brain and produce quite another clinical feature. It is not very likely that a gumma would produce the first symptoms of brain tumor, that the symptoms would disappear and that meanwhile the acusticus and the vestibularis would be destroyed.

(b) The examination of the spinal fluid: the negative Wassermann reaction as well as the negative butyric acid test.

(c) The blood count: the lack of hyperglobulia.

72. Jumentié: Les tumeurs de l'angle ponto-cérébelleux, Thèse de Paris, 1911.

4. *Tuberculosis*.—This is excluded by the examination of the spinal fluid: the lack of lymphocytosis as well as the negative reaction with Fehling's solution. Against this supposition we may, furthermore, recall that tuberculomata are tumors chiefly found in childhood. Henschen records that tuberculomata are found extremely seldom among the tumors of the cerebellopontile angle.

5. *Hydrocephalus Internus*.

(a) The cachectic form is excluded by the fact that the patient has gained so much in weight, by the lack of chlorosis, nephritis and polyneuritis, as well as by the lack of insolation, trauma psychicum or physicum.

(b) The chronic, infectious form is excluded by the negative reactions of the spinal fluid, and especially by the fact that the cultures remained sterile.

6. *Meningitis Serosa*.

(a) The acute form is excluded by the lack of somnolence, rigidity of the neck and rise of temperature.

(b) The chronic form is very probable: the persistence of headache, vertigo, ictus, anisocoria and psychic changes show very clearly that there exists in the patient a pathologic process which is still in the process of development. The fact that she presented symptoms of irritation from almost all cranial nerves, from the opticus (choked disk), from the oculomotorius (anisocoria), from the trigeminus (pains over the head and face, trismus), from the abducens (squint and diplopia), from the facialis (twitching of the face muscles), of the acusticus (tinnitus and loss of hearing), of the vestibularis (vertigo in longitudinal direction and general disturbance of the equilibrium), from the vagus (palpitation of the heart and choked disk), from the accessorius (cramps in the neck and in the shoulders), and that the symptoms appeared or disappeared combined or alone, can better be explained by the assumption of transitorily increased spinal fluid in the ventricles and in the arachnoid of the cerebellopontile angle than by the diagnosis of a slowly growing tumor. In favor of this assumption may be urged, furthermore, the increased pressure, the increased quantity and the high degree of clearness of the spinal fluid as it rushes out; also the negative butyric acid test.

CONCLUSION

A woman in the prime of life falls suddenly ill, without any increase of temperature or signs of meningitis infectiosa, presenting all the symptoms of brain tumor: choked disk, headache, vertigo, vomiting. These symptoms, after having appeared most alarming for fourteen days, slowly recede, the choked disk included, so that four weeks later

the patient feels normal. In the subsequent two years a unilateral deafness develops, followed one year later by the unilateral loss of the vestibular function, and from time to time attacks occur which tend to show an alteration in the left cerebellopontile angle. The patient shows now indications of the unilateral Romberg sign, which can be explained by unilateral lesion of the homolateral tractus spinocerebellaris. Pseudotumor can only be diagnosed with certainty by necropsy. If we do not make in this case the diagnosis as benign tumor of the cerebellopontile angle, but incline to that of pseudotumor, it is for the following reasons: sudden onset of the disease; retrocession of all the symptoms within a short time, especially of the choked disk; negative reactions of the cerebrospinal fluid and increase of its quantity; the fact that the unilateral deafness did not appear as a first symptom; the lack of a constant progressive paralysis of the other cranial nerves; the increase of the patient's weight, and finally, the time that has elapsed since the first attack.

I take pleasure in thanking Prof. Dr. José Valdés Anciano for kindly placing his ample library at my disposal.

HYSTERIA IN THE LIGHT OF THE EXPERIENCE OF WAR *

ARTHUR F. HURST, M.A., M.D. (OXON.), F.R.C.P.

Physician and Neurologist to Guy's Hospital

LONDON, ENGLAND

The war afforded an opportunity such as had never occurred before for investigating hysteria in men. The lessons we have learned can be applied to the elucidation of many of the problems presented by the hysteria of civil life. In this paper I shall attempt to explain the new conception of hysteria which I have been led to adopt as a result of three years of intensive study of the war neuroses.

I begin by proposing a new definition of hysteria:

Hysteria is a condition in which symptoms are present, that have been produced by suggestion and are curable by psychotherapy.

This definition differs from all others in not recognizing an hysterical condition apart from the presence of definite hysterical symptoms. Charcot believed that hysteria manifested itself in two ways: by the symptoms that were obvious to the patient and about which he complained, and by physical and mental stigmata that were present before the obvious symptoms appeared and which persisted after their removal.

PHYSICAL STIGMATA OF HYSTERIA

A characteristic feature of the physical stigmata he described, the chief of which were certain forms of anesthesia and narrow fields of vision, was that the patient never complained about them and did not indeed become aware of their existence until they had been demonstrated to him by the physician. Babinski showed that this was due to the fact that they did not exist until the physician found them, as they were actually produced by him unconsciously in the course of his examination. In a series of 100 consecutive cases of hysteria, which he examined in such a way that no suggestion could occur, neither anesthesia nor a narrow field of vision was ever found.

My investigations, carried on during the past twelve years, entirely confirm Babinski, and we have recently extended our observations still further. A spiral field of vision has often been described as even more characteristic of hysteria than the simple narrowed field described

* Address delivered before the American Neurological Association at Atlantic City, N. J., June 17, 1919.

by Charcot, which Babinski proved was only the result of the suggestion involved in using a perimeter. When, after the first examination of the field was completed, and second and third examinations were made without interruption, the field was found to become steadily smaller, this being due, it was supposed, to the abnormal fatiguability in such cases. Major J. L. M. Symns and I¹ found, however, that it was simply due to the method commonly used, in which the white disk of the perimeter is brought from without inward at each examination. When it was moved in the opposite direction, an outward spiral instead of an inward spiral field was obtained, the field becoming steadily larger until it reached the normal instead of becoming steadily smaller. By varying the method used, it was possible to obtain an inward spiral with one eye and an outward spiral with the other, or an inward spiral followed by an outward spiral with the same eye.

Accurate measurements made with J. L. M. Symns proved also that the supposed pharyngeal anesthesia of hysteria is a fallacy,² and that the percentage frequency of deficient, average and increased sensibility is exactly the same in patients suffering from hysteria, and even from such hysterical symptoms as aphonia and mutism, as in normal persons.

The areas of cutaneous anesthesia that have been regarded as characteristic of hysteria were shown³ to be simply those areas that an average layman would expect to be anesthetic if he were paralyzed, and which would therefore be likely to develop directly he is questioned on the subject and his cutaneous sensibility is investigated.

MENTAL STIGMATA OF HYSTERIA

Having disposed of the physical stigmata of hysteria, it becomes necessary to examine the mental stigmata. A study of the literature reveals a great diversity of opinion as to their nature. The stigma which is accepted by the largest number of writers, and which is the only one accepted by Babinski, is abnormal suggestibility. But our investigations have proved conclusively that, although abnormal suggestibility renders a man unusually prone to develop hysterical symptoms, there is no one who is so devoid of suggestibility that he may not develop them if the suggestive influence is sufficiently powerful. Whether a given person will develop hysterical symptoms under given conditions depends on the degree of his suggestibility and the strength

1. Hurst, A. F., and Symns, J. L. M.: *Seale Hayne Neurological Studies* 1:15, 1918.

2. Hurst, A. F., and Symns, J. L. M.: *Seale Hayne Neurological Studies* 1:1, 1918.

3. Hurst, A. F.: *Seale Hayne Neurological Studies* 1:7, 1918.

of the suggestion. It is clear therefore that abnormal suggestibility is simply a predisposing factor and is no more a part of hysteria than a tuberculous family history is a part of tuberculosis. Many cases of gross hysterical symptoms occurred in soldiers who had no family or personal history of neuroses and who were perfectly fit until the moment that one of the exceptionally powerful exciting causes, such as occur comparatively rarely apart from war, suggested some hysterical symptom; and after its disappearance as a result of psychotherapy the man was once more perfectly fit, and his subsequent history showed that he remained no more liable than any of his companions to develop new symptoms.

The following experiments made with Major J. L. M. Symns and Dr. R. Gainsborough⁴ show how unexpectedly suggestible the average normal individual is. We examined twenty-eight men who were perfectly healthy and suffering from no kind of nervous disorder, but who were attending an aural out-patient department for deafness, which was either unilateral or more severe in one ear than the other. Both ears were lightly touched, sometimes by ourselves, sometimes by others who did not know we were investigating, and the men were then asked which side they felt more closely. Eighteen replied at once that the ear in which the hearing was less impaired was more sensitive to touch than the other; the hysterical anesthesia which had been suggested by this simple examination was so marked in one case that the man was seen a few minutes afterward putting a pin through the lobe of his ear to amuse his companions. In 1859, Briquet stated that hysterical deafness is associated with anesthesia of the external ear, and this has ever since been regarded as an almost constant phenomenon, which was supposed to help in the differentiation of hysterical from organic deafness. The experiment just described throws light on the origin of this deeply rooted fallacy.

As soon as it is recognized that, although certain mental stigmata predispose to the development of hysteria, they are not themselves a part of hysteria, it becomes obvious that many cases of hysteria will be missed if it is only looked for in so-called hysterical persons. When, on the other hand, it is remembered that there is nobody who may not develop hysteria if the provocation is sufficiently great, it must follow that hysteria is infinitely more widespread than has generally been supposed.

Hysterical Symptoms Produced by Fear.—In the majority of cases very little difficulty is experienced in discovering the nature of the suggestion which gives rise to hysterical symptoms. The chief varieties seen in soldiers may be taken as examples, though each has a much wider application to the hysteria of civil life. In the first place, there are the symptoms which follow the condition of fear. Extreme terror

4. Hurst, A. F., Symns, J. L. M., and Gainsborough, R.: Seale Hayne Neurological Studies 1:19, 1918.

gives rise to certain very familiar symptoms, the individual becoming shaky, "paralyzed with fear," and unable to speak—"his tongue cleaves to the roof of his mouth." Under ordinary conditions the cause of fear is momentary and the physical results disappear in a few seconds. But during a heavy bombardment a man often remained terrified for hours. If the tremor, inability to move the legs and speechlessness persisted all this time it was natural that these symptoms of fear, which were not in any way hysterical, should so greatly impress the soldier's mind that the idea of a permanent condition of tremor, paraplegia and mutism suggested itself to him, with the result that when the original emotion had disappeared, its physical expression persisted as hysteria.

In the first two years of the war cases of this kind were given the unfortunate name of "shell-shock" in the belief that they were organic in origin and due to actual concussion caused by the explosion of powerful shells. Consequently, no attempt was made to cure them by psychotherapy, and the treatment by rest and sympathy helped to perpetuate them; this unfortunate result was increased by the use of the word "shell-shock," which gave the patient the idea that he was suffering from some new and terrible disease. When at last the true nature of the condition was recognized, it was found that psychotherapy not only resulted in the immediate disappearance of the symptoms, when they were treated in the special advanced hospitals opened for the purpose by the British and French and later by the Americans, but cases of two and three years' standing were also frequently cured at a single sitting in hospitals in England, such as the Seale Hayne. Although this form of hysteria was most common in neurotic individuals, a large proportion of the patients treated within the first forty-eight hours recovered so completely that they were able to return to the fighting line and showed no tendency to relapse. A few of the patients whose condition had persisted for many months before coming under treatment could not return to France, but such men were always able to go back to their old civil occupation and often had no underlying mental condition requiring further treatment, although in some cases the hysteria was associated with neurasthenia or psychasthenia, or both. Indeed, many patients at once lost such symptoms as headache, depression, insomnia and nightmares, which had troubled them for months or even years, directly the obvious physical symptoms, such as mutism or stammering, tremor and paraplegia, were removed by explanation, persuasion and reeducation.

Hysterical Symptoms Produced by Gassing.—The second great group of hysterical symptoms in soldiers resulted from gassing. The irritation of the eyes, throat and stomach caused conjunctivitis, laryn-

gitis and gastritis, the latter being due to the swallowing of saliva in which the gas was dissolved. The pain caused by the conjunctivitis induced the patient to refrain from opening his eyes with his levator palpebrae superioris; if, however, he tried to open them, his attempt was frustrated by a reflex protective spasm of his orbicularis palpebrarum. Under ordinary conditions the conjunctivitis had improved sufficiently at the end of three weeks for the eyes to be opened without difficulty, but if the patient was led to fear for his vision on account of previous weakness of the eyes, the previous loss of one eye, as in two of our cases, or too prolonged treatment with local applications, bandages, dark spectacles or eye-shades, the voluntary inhibition of the levator might be perpetuated as hysterical ptosis and the reflex spasm of the orbicularis as hysterical blepharospasm. As the uneducated layman associates the idea of blindness with inability to open the eyes many of these patients thought they were blind. Consequently, when they were taught to open their eyes it was found that they could only see indistinctly, as they had hysterical paralysis of accommodation, or less frequently they could not see at all, as they had become so convinced that they were blind that they had ceased to look, and, not looking, they could not see. Simple explanation followed by reeducation in looking resulted in permanent recovery. Similar cases, generally of much less severity and often consisting of nothing more than frequent blinking, are not uncommon in civil life.

In the same way the whispering in cases of laryngitis, which was originally in part voluntary to avoid pain and in part due to a protective reflex, was frequently perpetuated as hysterical aphonia. This was most commonly the case when an expert laryngoscopic examination had revealed the presence of some abnormal congestion or secretion, which led to intralaryngeal medication, as both the diagnosis and treatment afforded the necessary suggestion to perpetuate the idea in the patient's mind that his voice was permanently lost. When these patients were taken away from their unfavorable surroundings and treated by explanation, persuasion and reeducation, without any recourse to suggestion by electricity, anesthetics or other means, they invariably recovered. A series of 100 patients treated at the Seale Hayne Hospital were cured at a single sitting, although the average duration of the aphonia before admission was 205 days. About one third of these cases were not caused by gassing, but by the same suggestive influences as those that give rise to hysterical aphonia in civil life. We believe that the liability to relapse is greatly reduced by our simple method of treatment and the avoidance of suggestion.

The gastritis caused by gassing resulted in vomiting — a protective reflex which fulfilled its object by removing the irritant from the

stomach. The actual gastritis rapidly disappeared, and whenever the vomiting persisted for more than three or four weeks it was always hysterical. A very large number of soldiers were invalided from the service for so-called gastritis, the only symptom of which was vomiting. We found that cases of this sort could invariably be cured by a single conversation, if this was continued until the patient was obviously quite convinced that he was no longer suffering from gastritis and that he could eat anything without fear of vomiting, even if he had vomited after every meal for many months and had been kept on a strictly fluid diet.

Hysterical vomiting is much more common in civil life than is generally supposed. I believe that all cases of the so-called pernicious vomiting of pregnancy are really due to the hysterical perpetuation of the vomiting, which is physiologic during the first few weeks. Similarly the persistent vomiting, which is a common symptom in young anemic women and was formerly regarded as evidence of gastric ulcer, is generally hysterical and is due, like the vomiting in soldiers after gassing, to the perpetuation of a symptom produced originally by an acute attack of gastritis. The vomiting in chronic appendicitis, which may continue even after the removal of the diseased appendix, and of phthisis, and the cyclic vomiting in children, are in great part hysterical. All these varieties of hysterical vomiting can be cured by simple explanation, generally at a single sitting, just as in soldiers, and require none of the treatment by isolation, dieting and drugs, which is commonly given, even by those who suspect that there is a nervous element in the condition.

Hysterical Symptoms Produced by Trivial Wounds of Limbs.—Perhaps the most common of the hysterical conditions in soldiers were the paralyses and contractures,⁵ which followed comparatively trivial wounds of the limbs. A great many different forms were observed, and in many cases the paralysis and contracture were associated with marked vasomotor disturbances, including cyanosis or pallor, a pulse of small amplitude, edema and trophic changes in the skin, nails and bones. At the same time the muscles showed a moderate degree of atrophy, accompanied by an increased irritability to mechanical stimulation and certain changes in electrical reactions, which did not, however, amount to the reaction of degeneration. These changes were often most easily observed under a general anesthetic, which did not result in complete relaxation of the spasm until reaching a stage of anesthesia beyond that in which consciousness is first lost. Babinski and Froment experienced considerable difficulty in producing any

5. Hurst, A. F.: Seale Hayne Neurological Studies 1:43 and 244, 1919.

improvement in the paralysis and contracture by psychotherapy. Impressed by this and by the fact that the associated vasomotor and trophic conditions could not possibly be hysterical, as they were obviously neither capable of being produced by suggestion nor cured by psychotherapy, they concluded that the paralysis and contracture were also not hysterical. They revived the old theory of reflex nervous disorders, with which Vulpian and Charcot had sought to explain the muscular atrophy and spasm that often accompany diseases of joints. They ascribed both the muscular symptoms and the associated vasomotor and trophic disturbances to some obscure form of reflex action.

Our experience has led us to believe that there is no foundation for this theory of Babinski and Froment, and that all the cases they describe as reflex are really hysterical. The immobility and spasm may arise as a voluntary or reflex response to pain, or they may be due to localized tetanus, or to the application of splints or bandages, the abnormal posture assumed, the immobility and spasm being perpetuated by autosuggestion after the primary cause has disappeared, to which very often is added the heterosuggestion involved in treatment by electricity and massage when this is not really required. The hysterical paralysis and contracture which result could invariably be prevented by persuasion and reeducation directly the condition of the wound makes active movement permissible.

The hysterical nature of the paralysis and contracture is proved by their rapid cure with psychotherapy, as has also been shown by Roussy and others in France and Colin Russell in Canada. In a series of 100 consecutive cases treated at the Seale Hayne Hospital, the majority, if not all, of which might have been diagnosed as reflex, as each one of the cases shown in the illustrations of Babinski and Froment's book was represented in our series, ninety-six were cured at a single sitting of an average duration of fifty-four minutes, and the remainder were cured in four days, and two cases in two and four weeks, respectively, although the average duration of treatment before admission was eleven months. It is clear, therefore, that the paralysis and contracture are hysterical, as they are caused by suggestion and cured by psychotherapy.

Disuse of a limb, whether caused by organic disease or hysteria, leads to deficient circulation. This by itself is enough to explain the associated vasomotor symptoms, as they are most marked in cold weather and in persons who have always had a feeble peripheral circulation. They disappear temporarily, as Babinski and Froment showed, by artificially increasing the circulation by the application of heat, and permanently, as we have repeatedly observed, by restoring the power of movement by means of psychotherapy.

Deficient circulation gives rise in turn to deficient nutrition, so that the skin and subcutaneous tissues become atrophied, the bones decalcified as shown by the roentgen rays, and the nails thin and brittle. In a striking case, in which some trophic changes had developed as a result of hysterical paralysis and contracture of over a year's duration, and in which the power of movement was restored at a single sitting, the nails subsequently showed a very definite horizontal line separating the opaque, vertically ridged, thin and brittle part, which grew during the period of disuse, from the pink, smooth and otherwise normal part, which began to grow immediately recovery took place.

The changes in mechanical and electrical reactions and in the deep reflexes were also shown by Babinski and Froment to disappear when the circulation was temporarily improved by immersion in hot water, and we found that immediate and permanent restoration followed recovery from the paralysis and spasm as a result of psychotherapy. These changes therefore are nothing more than the functional effects on muscular tissue of deficient circulation.

In the same way the rigidity of the finger joints observed both in cases of organic nerve injury and hysterical paralysis and contracture, which persists under deep anesthesia, has always been regarded as due to adhesions or fibrous contractures, which only gives way under forcible manipulation with sounds of tearing and resulting effusion. This condition is really the result of some coagulative process in the fibrous tissue caused by the accumulation of products of metabolism, which are normally removed by the blood when the circulation is efficient. It is well known that a slight increase of mobility of such joints follows the application of warmth which improves the circulation, and we have found that complete and immediate restoration of mobility followed the return of the natural circulation as a result of the rapid cure of the paralysis and contracture. This must have been due to the removal of waste products permitting the temporarily coagulated fibrous tissue to assume its normal fluid consistence.

It is thus clear that the so-called reflex nervous disorders of Babinski and Froment are really hysterical, and that the associated vasomotor and trophic disorders are caused by the resulting disuse.

Hysterical Symptoms Produced by Injury or Disease of Nervous System.—The last group of cases is, I think, the most important, because it is one which is very common both in soldiers and civilians, though its true nature is comparatively rarely recognized. It consists of symptoms which are primarily organic and due to an injury or disease of the nervous system, but which are eventually in part or com-

pletely hysterical. When the structural changes produced by an injury or acute disease of the nervous system gradually diminish in extent owing to the disappearance of the vascular and other temporary changes which surround the comparatively small area of total destruction, if indeed such an area is present at all, the symptoms caused by the throwing out of action of the parts controlled by the nervous tissues primarily involved should disappear *pari passu*. Just as the physical signs in slowly progressive diseases, such as tabes and disseminated sclerosis, often precede the onset of symptoms, so in these cases the physical signs are generally still present when the functional capacity has returned to normal, and if the lesion does not disappear completely they may remain as permanent evidence of a past organic lesion.

In many cases, however, a man does not realize that his functional capacity is improving. If he has been hemiplegic, he has in the early days made repeated efforts to move his paralyzed limbs but without success, and he finally gives up the attempt and reconciles himself to the idea of permanent hemiplegia. If his physician is too much concerned with the possible dangers of early movement, he will exaggerate the patient's own fears of permanent disability, with the result that the organic hemiplegia is gradually replaced by hysterical hemiplegia instead of slowly disappearing as the organic lesion becomes more and more reduced in extent. A time may eventually arrive when the hemiplegia is entirely hysterical, but, as already pointed out, the physical signs of organic disease, such as extensor plantar reflex, ankle-clonus, exaggerated deep reflexes and lost abdominal reflex, may still be present on the affected side.

A number of additional signs have been described, particularly by Babinski, which depend on the fact that the behavior of the paralyzed muscles in organic hemiplegia differs in various respects from what an average layman would expect, so that a man with hysterical hemiplegia, the exact nature of which must depend on his own conception of how his muscles would behave if they were paralyzed, fails to show these signs. But if the hysterical hemiplegia was suggested by an organic hemiplegia, these signs would be present, as the patient would be trained by his own organic symptoms to maintain them in an unaltered form when they were no longer organic. Thus while the upper part of the face is unaffected, the lower, including the platysma (Babinski's platysma sign) would be paralyzed, and Babinski's pronation sign and the combined flexion of the thigh and pelvis (Babinski's "second sign") would be present. In the same way the characteristic

6. Hurst, A. F., and Symms, J. L. M.: *Seale Hayne Neurological Studies* 1:113, 1919.

posture of the arm and leg in organic hemiplegia would be perpetuated. We should thus be face to face with a case, in which the symptoms had originated as a result of an injury or disease which is known to result in organic hemiplegia, and in which the incontestible physical signs of organic disease, such as the extensor plantar reflex and the other changes in deep and superficial reflexes, as well as the characteristic posture and the accessory signs described by Babinski and others, are present, although the hemiplegia is entirely hysterical. Such cases can only be diagnosed by experimental psychotherapy. If, as occurred in numerous cases under our care, more or less complete recovery takes place—although of course the permanent physical signs of organic hemiplegia persist—it is clear that the paralysis is almost entirely hysterical, although grafted on an organic basis.

The old method of diagnosing between organic and hysterical paralysis thus breaks down, as the physical signs of organic disease do not, as is too often assumed, indicate that the paralysis is entirely organic, but simply that there is an organic element in the case, which may be quite insignificant in proportion to the hysterical. Moreover, it is no help in such cases to consider whether the patient is or is not neurotic, as the large majority have no personal or family history of neuroses, and are in every way normal except for the particular symptom from which they are suffering. No more powerful suggestion of hysterical paralysis could be imagined than organic paralysis, and no abnormal degree of suggestibility is necessary for its development.

We have seen cases of homonymous hemianopia, which is commonly regarded as always organic, persistent headache, amnesia, and epileptiform convulsions develop after head injuries; paraplegia and persistent incontinence of urine, after spinal injuries; paralysis and anesthesia after nerve injuries in the exact distribution of the nerves, the anesthesia even resulting in accidental burns; all of which were primarily organic and showed the characteristic features of symptoms caused by an organic lesion, although the recovery with psychotherapy proved that they were hysterical. In many cases, of course, recovery was incomplete, the proportion of hysterical to organic incapacity depending on the extent of permanent damage done to the nervous tissues.

In the same way we have found that the well-recognized association of hysteria with disseminated sclerosis is even more common than is generally supposed, that an hysterical element is frequent in tabes and may even occur in such a disease as Friedreich's ataxia. A soldier suffering from the latter disease, who had been unable to walk or stand without assistance and had been unable to feed himself or write for several months, improved to such an extent as a result of a week's

psychotherapy that he was able to walk steadily and use his hands for all ordinary purposes, although of course the physical signs remained unaltered and the ultimate prognosis is as hopeless as before.

We believe that the same principle should be applied to all organic disease, whatever part of the body is affected, and that the possibility of an hysterical and therefore removable element should be considered, however normal the mentality of the patient may appear to be. Our experience further shows that the ideal method of treatment in such cases is a rapid one — by explanation in language suited to the intelligence of the individual, combined, when necessary, with persuasion and reeducation.



AUGUST HOCH, M.D.

1868-1919

Obituary

AUGUST HOCH, M.D.

Through the death of August Hoch, THE ARCHIVES OF NEUROLOGY AND PSYCHIATRY has lost an important member of its editorial board. A wide circle of psychiatric workers and friends feel keenly the passing away of this much beloved man. The loss is most keenly felt by the many who were closely acquainted with Hoch's work and what he might have given to us from the treasures of over twenty years of rare clinical observation and study.

A few years ago signs of a familial arteriosclerosis asserted themselves; a severe attack of sciatica in 1916 yielded but slowly. A change to a well adapted existence in California seemed to reestablish a safe balance; even a somewhat tedious infection of the foot during the last winter had cleared up; but shortly after a happy twenty-fifth anniversary of his wedding, the second day of a visit to San Francisco, where he had gone in part with the hope of working in the Medical Library, he was overtaken by a peculiar collapse, with profound renal insufficiency and a rapid development of uremia.

Hoch came to this country in 1887, when 19 years old, to take up the study of medicine at the University of Pennsylvania. He came from a happy family and a genial circle of friends at the gymnasium of Basel. His father, a minister, had for years been superintendent of the City and University Hospital of Basel, Switzerland. Hopes of an academic career must have been deeply implanted in him and may have determined him, together with his friend, Charles E. Simon, to follow Osler to the Johns Hopkins Hospital. He graduated from the University of Maryland. He worked largely with Henry M. Thomas, and translated Hirt's "Textbook of Nervous Diseases." His first paper dealt with hematomyelia. In 1893 he was chosen to become psychologist and pathologist in the extensive scheme of research laboratories planned by Dr. E. Cowles at the McLean Hospital, and he was sent abroad for further preparation. He went first to Strassburg, with Simon Flexner, to work on brain anatomy with Schwalbe, then to Leipsic, where he endeared himself to Külpe and Marbe and Kiesow in Wundt's laboratory, and finally to Heidelberg where he became one of the contributors to Kraepelin's drive into the domain of a medically useful experimental psychology. Hoch's study of the effects of tea and its oils was made on the basis of some far-reaching generalizations by Kraepelin, especially concerning the facilitation of motor reactions. Hoch married Emmy Muench, of Basel, and then returned to start the

twelve years of work at the McLean Hospital, first at Somerville and later in an excellent laboratory at the new hospital at Waverley, Mass. When I met him for the first time, September, 1895, he was living in the village with his wife and his only child, Susie—in a genial home—and gave his whole enthusiasm and interest to a continuation of his psychologic and anatomic studies.

Edward Cowles had taken the superintendency of the McLean Hospital in 1879, after a brief training at the Hartford Retreat and a period of several years as superintendent of the Boston City Hospital. A man fond of speculation, with a decided yearning for progress, stimulated by Stanley Hall, at that time professor of psychology at Johns Hopkins University, he had an ambition to promote research in his well-endowed institution. His Shattuck lecture of 1885 foreshadowed his program of clinical speculation. He hoped to develop his psychiatric conceptions, leaving the clinical work very much on the old plan of having a few mainly administrative assistants, with the emphasis of innovation resting on the introduction of laboratory investigation. Dr. Hoch became the successor of Dr. Noyes, who had not been especially happy in this semi-academic and nevertheless isolated position. The chemical laboratory, destined to be the birthplace of Folin's reputation, soon was added; staff conferences aimed to harmonize the trends of work. The essentially different Worcester plan of organization laid the emphasis on putting the entire clinical staff on something like a research basis, developing the laboratories in the service of this foundation as means in talents and funds became available, but always with a clear appreciation of the importance of a sound and critical setting. Kraepelin's revolution of psychiatry in 1896 and Nissl's joining the Heidelberg Clinic led to Hoch's second period of work with Kraepelin in 1897. He returned in spirit and fact the full-fledged psychiatric leader of the staff, as well as an especially well trained histopathologist, and one deeply interested in putting the ergograph work into the service of clinical problems. Dr. Cowles never made a complete readjustment to the natural result of these developments, so that the clinical publications were retarded; but Hoch's work became more and more the clinical research with a wise perspective regarding the laboratory investigations for which we all admire him. His interest in the ergograph studies did not cease; but a special report on a patient with alternating days of elation and depression may have served as a damper with regard to the pertinence of the reactions to the specific kraepelinian disease-processes when the dominant process proved to be general paresis. In the first volume of the *Psychological Bulletin*, Hoch summed up the net result of that type of psychologic experimentation in its application to psychiatry.

The period of work with Nissl and Kraepelin in 1897 had a double effect on Hoch. He produced his studies on nerve-cell changes of the cortex in a case of acute delirium and a case of delirium tremens (1897) and on the nerve-cell changes in somatic diseases (1898), full of interesting details, in marked contrast to the numerous writings of that day which saw little more than "chromatolysis" in the cortex pathology. At the same time, from here on, the clinical studies began to predominate: the articles on mania and melancholia and manic-depressive insanity in the *Reference Handbook for Medical Sciences*, the unreality-feelings (1905), the studies on drug deliria (1906), the manageable causes of insanity (1909), the problem of toxic-infectious psychoses (1912) and a most important group of contributions to the study of personalities, the constitutional factors in the dementia praecox group, the mental mechanisms in dementia praecox, the relations of personality and psychosis, and the relation of insanity to the psychoneuroses. All these studies contain little gems of keen and yet direct and simple formulations of well observed clinical cases, in wholesome contrast to Kraepelin's method of presentation, which overwhelms the reader with collections of fragments devoid of personal settings. It was this departure in the work of Hoch that made it possible and perhaps imperative for him to pay more and more attention to the rôle of the personality so strongly emphasized by American workers.

In 1905, Hoch was induced to take the position of first assistant physician of the Bloomingdale Hospital at White Plains, N. Y. He had done some teaching at Tufts Medical School, and he became professor of psychiatry at Cornell Medical College at the same time as he was called to the directorship of the Psychiatric Institute of the New York State Hospitals on Ward's Island, in 1909. As a teacher of the Cornell medical students and of the assistant physicians in the State Hospital system Hoch found opportunities for the fullest expression of his spirit of investigation and formulation. A period of study with Bleuler and Jung and von Monakow, in 1908, gave him an intimate familiarity with the structural and psychoanalytical problems, balanced by an unusually keen sense for intensive clinical study of his patients. It was with the greatest regret that his numerous pupils and colleagues saw him depart for California—a loss compensated only by the hope that in his new environment he would be able to bring out more rapidly monographs based on material from the McLean and Bloomingdale hospitals and the Psychiatric Institute.

From his advent at the Psychiatric Institute he took the greatest interest in the further development of the *Bulletin of the New York State Hospitals* into a psychiatric journal of the first order, the *Psy-*

chiatric Bulletin. In California he hoped to found a special journal, but was finally induced to combine his effort with the newly planned ARCHIVES OF NEUROLOGY AND PSYCHIATRY in order not to divide the efforts where union appeared most urgently needed. During the later years in New York he also proved a most helpful contributor to the interests of the social side of psychiatry, partly in connection with the National Committee of Mental Hygiene. The New York Psychiatric Society and the American Psychopathological Association count him among their most active and influential former presidents.

Hoch was not a generalizer. His strong point and first love was that of appreciation of the finer niceties of description and interpretation. He was not a philosopher, but a man with a keen sense for specific features and aspects of cases or problems. A definite cell alteration, a definite rhythm in the plotted results of his ergograph and kindred experiments, a fact such as passivity or specific traits revealed in the personality-study, which he brought out in collaboration with his friend Amsden, reactions like distressed perplexity, or the death and rebirth concept in some of his patients, would absorb his whole-hearted attention, and would tend toward monographic studies. It is to be hoped that the rich material practically ready for publication will be added to the noteworthy array of publications from his pen.

Hoch's personality was somewhat retiring and at the same time most genial. He was capable of the keenest and heartiest enjoyment of friendship and social happiness with his chosen friends and his family. He gained the warmest affection of his patients. He always remained closely attached to his native country, but was a loyal and warm-hearted citizen of the United States, and deeply appreciative of the beauty of the East and the South, and especially of California.

Hoch's work, his friendship and warm-heartedness will leave an enduring impression on all those who were fortunate enough to know him. His contribution to American psychiatry would fully deserve a memorial edition of his publications, together with the works which we hope his friends and co-workers will bring to speedy completion. What a pity that he should not have seen the day when his many friends and admirers might have celebrated with him the publication of his many-sided and well-poised collected works, somewhat as has recently been done to honor Cornelis Winkler on the occasion of the twenty-fifth anniversary of his professorship of neurology in the Universities of Amsterdam and Utrecht.

ADOLF MEYER, M.D., BALTIMORE.

CHARLES ARTHUR MERCIER, M.D.

1852-1919

Dr. C. A. Mercier died at Bournemouth, England, Sept. 2, 1919. It was my fortune to meet him less than six months ago at the home of Sir William Osler in Oxford and a short description of that "great evening," as Osler put it, may be of interest to American neurologists and psychiatrists.

Last June, when on leave from the army, Sir William and myself were left alone one evening at his house and I looked forward to a quiet dinner with him, but a little twinkle in his eye when I mentioned our solitude gave the secret away, and I knew he had something of interest planned.

appearance, saying good-bye to his nurse, a British matron of appearance, saying good-bye to his female nurse, a British matron of uncertain summers, who had come with him and was to return for him later. Scarcely four feet in height, with enormously bowed legs and long arms, a kyphosis so marked that it seemed as if his great head, which was fully twice normal size, was too much for the spine to hold, a gaunt face with heavy eyebrows shading a piercing pair of eyes — such was Dr. Mercier, a marked victim of Paget's disease. He was dressed in evening clothes with an impeccable purple velvet jacket. Over one ear was a sort of telephone receiver to which was attached a long trumpet of flexible hose, his only auditory connection with the outside world. He talked with a clear, silvery voice using particularly pure English and careful articulation. His flow of language was superb, a great mass of witty conversation, interspersed with brilliant epigrams and anecdotes mostly relative to fifty years of British neurology which he had witnessed.

At dinner he was a perfect fountain of knowledge, appearing to know almost everything about neuropsychiatry and every one connected with it for the last two decades. When the fountain threatened to even suggest a slight drought, Sir William would lean over and whisper into his ear trumpet such pregnant themes as "Hughlings Jackson!" or "Johnathan Hutchinson!" and we would be inundated by a perfect deluge of rambling anecdotes, a veritable spring freshet of information. He was never at loss for a word, a brilliant incident or a humorous story. We are necessarily the listeners, but who could not sit and listen by the hour to such a man!

He told us one or two interesting things about his method of work. For a number of years he had been more or less confined to his house in a chair owing to his infirmity. He arose at four in the morning and, after a bit of fruit, wrote or dictated until ten, when he had a small breakfast followed by a period of a few hours of reading or letter writing. After luncheon came a period of exercise, out of doors if possible, followed by three or four hours of writing or dictating until dinner at eight. This period, he told us, was his best time for work. After dinner came another period of work until twelve or one. Sometimes during the day he rolled his own cigarets and made them a little damp with water so that they would smoke longer. He invariably wrote with a cigaret between his lips. Surely such a routine of labor is seldom depicted in these times. Edison, of course, is noted for his long consecutive hours of work. In the past, John Hunter furnishes the classic example. In 1768, he arose at five and worked until nine in his dissecting room. After breakfast he received patients until twelve, made calls until four, dined, slept for an hour and wrote from six until midnight or later.

A complete story of Mercier's life would be a long one, but a few points may be related. Born in rather poor circumstances in Scotland, he first went to sea as a cabin boy, but soon was drawn to London for his medical education where he fell under the spell of the old London Hospital and Hughlings Jackson. Here he received his groundwork in neurology and mental disease, subjects which filled his life to the end. He was especially interested in the legal aspect of mental disease, and some of his strongest books deal with the relation of crime to insanity. Four of his better known books are: "Criminal Responsibility," a "Textbook of Insanity" (1902), one of the first comprehensive views of insanity in its practical aspect, "Psychology, Normal and Morbid," and his last and perhaps greatest work, published in 1918, "Crime and Criminals."

He was a brilliant speaker and reveled in argument. His nimbleness of brain, strong moral nature and unflinching courage, made him a very formidable opponent in any debate. As a correspondent, especially for the *London Times* and British medical journals, he was considered the most brilliant letter writer of the last decade. It is said that "he never wrote a slovenly sentence and never spared himself the most assiduous effort to make his meaning clear and precise to his readers." He had a weakness which sometimes marred his otherwise convincing logic in that he sometimes sacrificed points in debate in a desire to score, and allowed his wit to run away with his judgment.

This weakness, however, is scarcely noticeable in his medical writings. His style was clear, incisive and accurate, for he was almost a purist in the use of the English language.

He died suddenly, actively at work, a victim of a remarkable malady. As Osler says, he "went down as he promised with all the flags flying." With his death psychiatry loses one of its most brilliant and distinguished ornaments.

HENRY VIETS, M.D., NEWTON, MASS.

Abstracts from Current Literature

THE FREUDIAN DOCTRINE OF LAPSES AND ITS FAILINGS. A. A. ROBACK, *Am. J. Psychol.* 30:274 (July) 1919.

This essay is one in which the actual and psychologic center is unconsciously touched within the first paragraphs, which often are to be esteemed as highly as the first dream. Roback states that the lapse, the doing of something else than that intended, as seen by the common person, has in it the notion of portent, a precursor of a fortunate or unfortunate event. To him it is a symbol. To Freud it is a symbol also, not of extraneous origin, but of a hidden motive in the mind of the person "guilty of the slip."

The author, in his contradiction of Freud, is poised also in a general contradiction of the common person's deep psychology, so like to Freud, and the common person and his notions is a far more dangerous opponent than is perhaps the founder of psychoanalysis. No one knows this more shrewdly than Freud and no one has more significantly acknowledged his debt here in a tribute to the curious perception by homo sapiens of just enough of his soul that he may disguise it from himself by a projection outward in an imputation of the wrong as resident outside self. We suspect the author, as one of the race, has himself expressed some such notion in utilizing the connotation "guilty" in defining the one who has made the slip. At least one knows that in violently reacting against tradition there may be concealed a real acknowledgement of it.

It is of interest, then, to extract from this essay the conscious rationalizations affecting the matter of lapses, realizing in it that the author is only more shrewd than the rest of us, locating these slips not in terms of portent or hidden motives, but in psychologic happenings or certain habitudes in no wise to be viewed as conditioned from within, but totally from without, and that in no symbolic manner, but one that is objectively mechanistic in its entirety. It is blanket acquittal which he achieves of man. With it is the usual bitterness against Freud, whom he admires "but"—; "his doctrine should receive its coup de grace;" analysts other than Freud are "devotees," "epigones;" a passing allusion to "complex distilleries" entertains one. All of this may introduce the psychologic values or motives of the contribution with the common unconscious background as occupied with the project of motives outward and outside self.

To present his statement, for there is no argument, the slip is ascribed to a set of causes, variously presented under terms of "repetitionary assimilation," as in saying big bills instead of big pills; in the elimination of prefixes, as "un" or "in," where the lapse is located in the unintentional interchange of negative and positive concepts, this grouped under the general notion of "omissions;" in mistakes due to "anticipation" instead of repetition, as in writing something earlier in a phrase than was meant; in errors of "graphic habituation;" in "perseveration" of a letter to a part where it does not belong.

These are the "mechanisms" which, neglected by the freudians, are here restored by the author. Certainly they appear so obvious that one might wonder at the earlier failure of discrimination. Yet in the midst of what we

assume to be the usual "procession of causes" one is even more driven to wonder at a negation of any deeper penetration, until one appreciates a definite refusal on the author's part of any such excursion. This refusal is not limited in its statement to a ridicule of the unconscious motive, but sharply defined in a method which, after examining the word and the sentence preceding the slip, looks into possible associations where, in opposition to Freud, emphasis is laid "on the actual association in the mind between the word intended and the misexpression," a totally objective relating. He denies any resort to the "hidden unconscious forces that are constantly distilling sexual and other complexes." Nor is the urge to exclude the unconscious limited to the matter of lapses; there is expressed a hope for a final coup de grace of Freud, who has far more than the "Psychopathology of Every Day Life" on his record.

In a way this attempt at a total discrediting of the freudian doctrine of unconscious determination might well orient one as to the value of the specific arguments advanced as alternative explanations of the slip or lapse. It has hindered the author in a wider approach to his own theory of mechanism and limited the argument to statements rather than proofs. It has shut off many sources. Jung long ago in his association studies described in outer associations much of what might be included in the varied mechanisms of "anticipatory" or "repetitionary" assimilation, "graphic habituation," etc. Kempf in his "Autonomic Personality" presents suggestions of a result of conflict in the matter of occupation of nerve tracts. Sherrington's studies possess a large value while any work at psychoneurotic symptoms might clarify and reorder the writer's concepts.

It was, of course, an unfortunate assumption that, because of the universality of lapses, one might more readily approach and study mechanisms here than in the compulsion or phobia or other psychoneurotic formations. It is possible, indeed, to differentiate groupings of errors, define them and even make laws for them; but to deny the presence of deeper laws, physiologic and psychologic, toward which any of the above indicated lines might lead, is rather intolerable. Worse, it denies any amplification of theory promised in a contribution such as this. Might the mechanisms, defined by the writer, be correlated to more fundamental notions, both were gainers.

This possibility is denied by the attitude as to the unconscious. It is this which has made the argument thin and possible of no larger valuation than is here attempted.

PARKER, New York.

THE ABDERHALDEN REACTION IN THE ENDOGENOUS PSYCHOSES. GOTTFRIED EWALD, Arch. f. Psychiat. 60:248, 1919.

The author found the Abderhalden reaction positive in 80 per cent. of praecox cases. In 51 per cent. the positive reactions were obtained by proteolysis from brain tissue and genital glands; and in 40 per cent. from the combination brain, genital glands and thyroid. Katatonia and hebephrenia showed the strongest reactions. No parallel was found between the ferment content of the blood and the clinical course of the disease. As compared with 80 per cent. positive reactions in praecox, 60 per cent. of manic-depressive cases and 50 per cent. of hysterical and psychopathic cases gave positive reactions. The observation is considered important that in mania the reaction was often obtained from thyroid alone and in melancholia from liver proteolysis. Although the author strongly maintains the specificity of the reaction, he does not believe that it is of practical value in forensic medicine.

The Abderhalden reaction in psychiatry dates from the publication of Fauser, in 1912, in which he maintained that whereas in organic brain disease, such as paresis and in praecox, the reaction was positive, demonstrating organic proteolysis, it was negative in the so-called functional psychoses—manic-depressive insanity, hysteria and psychopathics. Further experience with the test has been productive of quite divergent opinion as to its value. Recently Van Slyke, Vinograd-Villchur and Losee, from the Rockefeller Institute, working with pregnant serums, adopted for the measurement of serum protease the amino nitrogen determination as being both a quantitative and specific test for proteolysis and superior to the general methods in vogue in the Abderhalden test. Practically every human serum, whether from a male, a pregnant or nonpregnant woman, showed protein digestion with placental tissue prepared according to Abderhalden. They accordingly not only deny any specificity for this test but consider it valueless as a diagnostic measure. If, therefore, the test as originally suggested for the determination of pregnancy has not yet been generally accepted as specific in this condition, one is justified in accepting with considerable reserve the conclusion that the reaction is specific in psychiatry when based on the less well understood, organic changes in mental disease.

SCHALLER, San Francisco.

PSYCHOLOGICAL ANALYSIS AND RE-EDUCATION WITH CASE STUDIES. MARGARET J. HAMILTON, *J. Abnorm. Psychol.* **13**:324 (February) 1919.

One meets here "applied psychology" among the psychoneuroses. "Psychoses of rebellion," "psychoses of fear," as terms designating the writer's nuclear notion of the epilepsy previously diagnosed in two of the case reports, show a certain probable drift. These appellations, rather odd to the psychiatrist, go with a strong antifreudian protest; the writer's work is "psychological analysis," not psychoanalysis. Not only, however, is the voice the voice of Esau, but other lineaments are reminiscent; there are "complexes, unconscious motivations, strivings, conflicts, complex discharges," all laid in an amorphous matrix, for no clinical framework is to be seen and the case recitals run along the lines of a fair social service worker's report.

The two cases of epilepsy are "cured." This should arrest attention. The results will gain meaning if one may see by what course they have been achieved. This is the core of the contribution. Clark's excellent work on epilepsy has oriented us as to the usefulness of a considerable reeducation as a corollary of psychoanalytic procedure and physiologic interpretation. In Hamilton's cases it is the reeducation solely which really presents. What is perhaps amazing is the shallowness of the proper reductive analytic process, for it is obvious that the so-called "psychological" analysis is full of lacunae.

Here, then, one poises the question as to the results defined in the reports. In psychoanalysis there is now being more sharply defined notions relating to the necessity of resolving the repressed and relived attitudes of the patient at the site of the analysis. The analyst is driven to the need of breaking through these, as they are re-presented to him. In measure as this is achieved so is the further reduction of the unconscious complexes made possible. It is, moreover, apparent that by and in the same measure is the analyst placed in position where the "prospective" trends or sublimations of the individual may be made to move forward. Certain analysts, indeed, take the position that much of the laborious reduction of complexes might be left if, in the relationship between patient and analyst, there came to be gained a relaxing of the ancient inhibitions, relived at the site of analysis, and there to be undone and released.

It seems as though this were the exact function vaguely described in many words by the author as eventuating in her treatment. The function has been rather blindly performed and quite too idealistically; but what is more important, with no expressed appreciation of the hazards included in this venture, for one knows too well that definite dangers to the patient are inherent in this part of the work, calling for the shrewdest estimate of behavior transformations given in clinical outlines. A certain exaltation of this functional relationship between the writer as the teacher and the patient as the pupil would indicate an affect that might quite as likely be of disservice as service. Awareness of this is lacking, a gap which would be less likely were the writer to have scorned less the experience offered by a just psychoanalytic orientation.

But beyond this one is again confronted with the question as to the wisdom of the psychiatrically unoriented worker interfering in a range where the widest concepts are too narrow. The specific contributions of a reeducation type are useful and define their need; in this, however, they locate for themselves their proper inclusion within the hands of the neurologist and psychiatrist.

PARKER, New York.

HYSTERICAL ANESTHESIA; WITH SPECIAL REFERENCE TO THE
HYSTERICAL ELEMENT IN THE SYMPTOMS ARISING FROM
INJURIES TO PERIPHERAL NERVES. A. F. HURST AND S. H.
WILKINSON, *Seale Hayne Neurological Studies* 1:171 (April) 1919.

Hurst and Wilkinson set out to demonstrate that the paralysis, and more particularly the anesthesia following organic peripheral nerve injury, are often perpetuated as hysterical symptoms and may readily be removed by suggestion. Nine interesting cases are presented, including median, ulnar and musculocutaneous palsies and one instance of hysterical flaccid monoplegia (arm), in which the original anesthesia was presumably due to peripheral anemia following six weeks' splinting. In all the cases both the motor disability and the anesthesia yielded promptly to suggestion therapy, thus clearly stamping them as hysterical. Unfortunately the authors were under the disadvantage of seeing their cases late and the organic nature of the original conditions is not always clear. To be sure, there is a history of bullet wounds and mention of one ulnar nerve operation, but the extent of the original nerve lesions is in doubt. If case notes, including the electrical reactions, had been available, the organic side would have been more convincing. On this point, the authors conclude that, "a gunshot wound in the immediate neighborhood of a nerve produces minute changes in its structure which quickly disappear, but, evanescent as these concussion changes are, they are none the less organic and the paralysis and anesthesia they produce are primarily of organic nature." An interesting feature of the article is the attempt to show that hysterical anesthesia developed without heterosuggestion by a second person. Instances are cited in which patients were first made aware of anesthesia by accidental burns. Babinski's contentions regarding the rôle played by suggestion in the production of "pithiatism" are so broadly inclusive, that it is practically impossible even theoretically to exclude all possible sources. With the A. E. F. in France, the reviewer was interested in trying to eliminate the possibility of this kind of suggestion in some quite recent cases. A few hysterics came directly to his hands without the previous intervention of any medical agency, and in occasional instances even first aid had not been rendered. It seemed reasonable to assume that there had at least been no outside sugges-

tion, but even then all accidental sources could not be absolutely denied. Further, it must be remembered that the existence of hysteria does not by any means rule out the possibility of an element of malingering and burns may be consciously self-inflicted. Rosanoff,¹ in a recent article, stresses the concealed illicit, morally untenable motive of the hysteric and indeed regards it as the only factor which actuates hysterical conduct. Hurst and Wilkinson in this and previous studies have made a valuable contribution to our knowledge of hysteria and have suggested an interesting field for further investigation.

STRECKER, Philadelphia.

TREATMENT AND STUDY OF TWELVE NONPARETIC NEURO-SYPHILITICS TREATED BY INTRAVENTRICULAR INJECTIONS OF SALVARSANIZED SERUM. A. L. SKOOG AND KARL A. MENNINGER, *J. Nerv. and Ment. Dis.* 50:114 (August) 1919.

The technic for preparation of serum is practically the same as that for the Swift-Ellis method. The skull is trephined under local anesthesia with the usual aseptic precaution. The site selected is usually the frontal lobe, although other sites may be used. The authors prefer an area near Keen's point, only instead of 3 cm. above the external auditory meatus, they select a point 5 cm. above and 5 cm. posterior. The insertion, angulation and depth of the needle depends on the site, age and dilation of ventricles. Blunt needles are used (the pressure of cerebral fluid is the same as that of spinal fluid). The quantity removed is the amount that flows out spontaneously. The serum is then injected by gravity or syringe about two thirds to the amount removed.

The laboratory findings showed marked changes for the better in two cases, slight improvement in five, no changes in three (three cases; records were incomplete) and two died.

The authors report twelve cases treated by this method. Two showed marked, and six slight, clinical improvement. Subjective symptoms were more marked than objective findings. Two cases showed no improvement. The authors state that none of the cases were worse after injection. They report two deaths in twelve cases.

The work of the authors is very interesting, but the results as obtained are not at all brilliant, for out of twelve cases treated, two died, one as they admit as a direct result from treatment and the other possibly as an indirect result. They claim "rather remarkable improvement" in only two cases.

The types of cases selected for treatment were such as would ordinarily respond to the usual intensive intravenous injections.

DELONG, Philadelphia.

A PSYCHOLOGICAL STUDY OF SOME ALCOHOLICS. L. PIERCE CLARK, *Psychoanal. Rev.* 6:268 (July) 1919.

One may introduce the pragmatic aspect of this study in two paragraphs by the writer: "They (the patients) are for the most part individuals whom I have very carefully studied over a period of years and one may say they illustrate in a measure the end results of treatment;" "Perhaps in the vast majority of cases one may optimistically hope for an arrest of the habit if

1. Rosanoff, A. J.: A Study of Hysteria Based Mainly on Clinical Material Observed in the U. S. Army Hospital for War Neuroses at Plattsburg Barracks, N. Y., *Arch. Neurol. & Psychiat.* 2: 419 (October) 1919.

proper precautions and lessened social demands are made upon these special types of interiors." From these two statements one is borne to a consideration of outcome in the six patients cited.

In Case 1 there is offered the suggestion of an "ultimate and automatic (?) cure," residing in a marriage undertaken eighteen months after coming under a supervisory regimen pursued by the author and directly following the only spree defacing this clear record. Since marriage there are only occasional drinking periods of "a day or two a year," "when under the sympathetic attentions of his wife he grows mellow." In Case 4, after remarriage, and as in Case 1, the wife has taken over his entire care, as "a mother might a large over-grown boy." He no longer drinks, nor further philanders, but now is the head of a large company. These two cases rather stand by themselves and, as the writer states, are "interesting."

Case 2 is that of a woman, toward the close of the observation period separated from her husband, after an attempt to resume relations and following two years of improvement due to treatment; for a year after this separation another period, free from drink, interposed itself, following which appeared an attachment to an elderly woman from which is dated further though more moderate drinking, "a good deal of moral and mental dilapidation" and "with no further effort to live a healthful social life."

In Case 3 the analysis was broken off, due to a resistance developing on the heels of "an explanatory coup" effecting the homosex motive. His wife, "who gives little concern for the complete reformation of her husband," is considered a "lukewarm ally within the family" and as such to be a "serious drawback to any reformation." In Case 5, following analysis and at the end of several years of good health, the patient represented himself to the author not with the depressive episode earlier enclosing his drinking, but with a paranoid trend. The author views this as uncovered by the analysis. While in this trend "he fortunately stopped drinking."

With Case 6, a psychoneurosis, in which drink appeared as a substitute for unconscious desire to become important, the drinking ceased under treatment. These are the terminations, the end results of treatment. If one is to hope for an arrest of the habit, it is well, as the author implies, "optimistically" to hope.

As clinical groups one is made a psychopath, one a constitutional inferior and two "periodic depressives." This is, perhaps, the significant note of the contribution and deserves a larger emphasis. The matter of psychotic background holds sufficient to give one pause in a too radiant contemplation of cure. The case histories, compact and admirable as records, do not entirely satisfy in a detailing of the psychotic movement. The *deus ex machina* is not always best seen when related so largely in terms of complex and mechanism. Nowhere is the "nothing but" less acceptable than in the alcoholic. In the introduction, however, there is advanced the notion, familiar to us through Jung and Jelliffe, of different unconscious levels with different degrees of intoxication "releasing varying levels of strivings and conflicts." This follows on the heels of a number of discrete and more strictly freudian notions.

It is made obvious by the writer that psycho-analysis, though less favorable for the alcoholic than for other cases, is capable of yielding a needed orientation of the problem. The sharpest illumination appears here by defining in this group a psychotic field still considerably obscured by moral prejudice and a too large assumption of singly effective exogenous agencies.

PARKER, New York.

THE PSYCHOLOGIC ASPECT OF FREE-ASSOCIATION. THEODORE SCHROEDER, *Am. J. Psychol.* **30**:260 (July) 1919.

The essay deals with symbolic thinking and presents rather acute observations; this quite apart from the emphasis throughout laid on a general psychic determinism, made perhaps to occupy an over-conspicuous place. The data utilized are from a set of free associations, collected during a kind of reverie, and under conditions where any relation to an analyst or, indeed, to analytic procedure, might well be out of the question. The current organic stimuli, imputed by the critics as the other general agent effective in production of associations and dream content aside from analytic suggestibility, referred to above as excluded, were of a nature which could give no clue, "either in objective connections between the words or between the objective things which these words usually symbolize."

He states his problem, thus stripped unusually clear of the two imputed causal factors, by asking, under the "personal psychic contributions" of his collected free associations, what kind of thinking is involved in these as well as seeking here a deeper dynamic determinant than that resident in the causations imputed by the critics.

In thus seeing the words in his free associations as significant of something emotional in his own psyche, he passes on to a consideration of these words, not as symbolizing something solely objective to himself; they symbolize what he refers to as his "subjective symbolization" of objective realities. This subjective symbolization includes his concepts and feelings in being themselves symbolic of objective things. So the words are, the symbols of deeper symbols of the objective realities; the symbols which the words symbolize are thus represented in feelings and concepts.

This point is rather important; it gives a kind of coloration to thinking which in some degree appears not only universal, but also presents a view of thinking as a process which conscious logic has largely appeared to deny. It is not words, symbolizing objects, but words symbolizing symbols, as "symbolizing the symbolization of related objectives," and this "symbolization of objectives" is one which encloses feelings and concepts. It is not merely that the symbol represents an unconscious feeling or idea but that this feeling or idea becomes current only with this symbol as its core. The outer wrapping is the word, another symbol; but beneath is the deeper symbol.

The progression and evolution of thought has admittedly gone on with the increased reference for meanings to other objectives; one objective comes to be more sharply and inclusively defined by others. Yet in the procedure of analysis, this is reversed; psychopathology deals with this variety of language and not with the evolved expression. To criticize procedure one ought to speak its tongue or at least understand it. It is this on which Schroeder insists. There is much to amend, to change; this is welcomed. But in doing this one must go back somewhat to *lingua franca* of primitive thinking. The author's persuasive attempt to make this point and to define these necessities has formed a valuable contribution, framed in the discussion of a set of free associations which illustrate his goal.

PARKER, New York.

AN ADMINISTRATIVE IDEAL IN PUBLIC WELFARE WORK. OWEN COPP, *Am. J. of Insan.* **76**:1 (July) 1919.

Most storms of criticism directed against the present care of the insane and the demand for consolidation of state departments, Dr. Copp believes, get their driving force from defects in institutional management. He presents a remedy.

The state must divide its activities into coordinate departments, each one small enough to allow an expert to direct it. In a middle-sized state such departments would be public health, mental health, rehabilitation (reformatories, etc.) and social service. Control in each department would lie with three directors, one a full-time expert. All directorates would come together in a general board of supervision, which would establish its own agencies for investigation and publicity, and for cooperative community service.

Reasons that make such a plan good may be overlooked in the first reading of such a compact paper, although the accompanying diagrams are helpful. (1) The control relation exists in activities which can be fairly represented by the expert. No man is asked to control two such diverse problems as the care of the insane and the care of prisoners. (2) The supervisory relation is located in a board which slights none of the coordinate departments, and which can have for its field of work general problems too big for any specialized directorate, such as those between states and those between state and national organizations. (3) The central commission also can furnish consultation to all departments (the good relation of advice without control) in mental and physical health and institutional management. (4) The scheme protects the autonomy of the unit activities and of the highly trained individual without whom systems tend to go to pieces. It is centralization without a dictator. It appeals to the spirit of cooperation, and its force comes from the power of public opinion.

BOND, Philadelphia.

THE MENTAL ATTITUDE OF THE PENSIONER. A. ROBIN, Seale
Hayne *Neurological Studies* 1:222 (April) 1919.

Robin's article is particularly instructive at this time when our country and the other great nations are facing the tremendous difficulties in the way of a practical administration of the pension lists. The author finds that the neuropsychiatric pensioners are classified in one of the following groups: those who are cooperative and anxious to get well; those who subconsciously, and in some degree consciously, withhold cooperation; and finally the undoubted malingerers who deliberately plan to retain their feigned disabilities. Under the present ruling, the patient is apparently able to leave the hospital at his own volition, without thereby changing his pension status, and consequently, the British government in this respect is more or less at the mercy of the clever fraud. In this connection, it is interesting to recall the recommendation of the Neurological Society of Paris: In general, purely hysterical manifestations entitle one to no recompense. Exceptionally, a percentage of disability may be allowed somewhere between zero and 20 per cent., but in no case should the latter figure be exceeded.

STRECKER, Philadelphia.

Society Transactions

BOSTON SOCIETY OF PSYCHIATRY AND NEUROLOGY

Regular Meeting, April 17, 1919

GEORGE A. WATERMAN, M.D., *President*

CONDITIONED REFLEXES AND PSYCHO-ANALYSIS. Presented by DR. DONALD GREGG.

Unconditioned reflexes are those in which a given stimulus is answered by a response such as might normally be expected. A stimulus artificially associated with an unconditioned reflex produces a conditioned reflex.

Psychoneurotic persons are sensitive both to slight emotional stimuli and to stimuli from many sources. Unfortunately, accompanying such emotional sensitiveness goes a facility to develop conditioned reflexes which may seriously interfere with efficiency and happiness. Psychoneurotics have an abundance of reactions of all sorts. In fact, "being nervous" usually consists of a realization on the part of the patient that stimuli produce excessive or bizarre reactions on him. Does not psychoanalysis mean merely the study of the mechanism of the origin of such reactions? Considered from the point of view of physiology, are not many of the cases that we see analogous to the dog whose saliva flows when the bell rings, though the piece of meat may be long since lacking? Is not psychoanalysis stripped of its glamour and mysticism merely this? It is easy to talk of psychoanalysis, subconscious buried complexes, mental catharsis, etc., etc., but if it is our object to help our patients to understand their mental life, is it not our duty to have catharsis, like charity, begin at home, and to think simply and clearly ourselves and not to float off into deep water, if we can explain most of our cases in terms of conditioned reflexes and the universal impulse of self-preservation?

A CASE OF CEREBRAL HEMORRHAGE. Presented by DR. E. E. SOUTHARD.

Photographs of a brain from a case of possible lethargic encephalitis were shown. These photographs disclosed localized and diffuse hemorrhages. The case was one giving a history of influenza and showed lethargy as a mental symptom. There were to be seen in the region of the hemorrhages many polynuclear leukocytes grouped about the vessels of the meninges. Histologically, two possible processes were to be seen, one hemorrhagic, the other inflammatory.

ENCEPHALITIS LETHARGICA. Presented by DR. C. B. McDONALD.

In this paper eleven cases of encephalitis lethargica were reported. One case was described with much detail. The other cases were grouped and a study made of symptomatology, pathology and etiology. Every one showed some cranial nerve involvement and lethargy of varying intensity; some showed involvement of the pons, bulb, basal ganglion and spinal cord. All of the patients had fever, and seven of them had spinal fluids with a normal variation. The mortality was two out of eleven cases. The lethargy varied, in some patients associated with delirium. There were no convulsions. The cranial nerve involvement in association with the lethargy superficially characterized the disease in every

case. Pathology was discussed from the point of view of pathologic findings of Netter, Marinesco, Von Econimo, Basil and McGrath. All these authors found the same condition and increased vascularity shown by congestion of vessels, small punctate hemorrhages and engorged veins in the absence of meningitis.

Etiology: No definite organism has been obtained. Fever was present in all cases. The nature of this disease was discussed relative to infantile paralysis, meningitis and botulism. The conclusion drawn was that the disease as encountered in America and as shown by these cases agrees most strikingly with the cases of Von Econimo who described and named the disease. It is of unknown origin of an infectious nature, and occurs following epidemics of infection, commonly spoken of as influenza. For practical purposes its clinical signs and symptoms are sufficiently characteristic to justify accepting Von Econimo's establishment of the disease entity, encephalitis lethargica.

DISCUSSION

DR. E. B. LANE asked, "Is the lethargy continuous or intermittent?" He had seen one patient who had had several attacks and who died at the final attack. He had also seen one case of general paresis which the family insisted developed after an attack of influenza.

DR. W. E. PAUL spoke of seeing a case that continued over fifteen weeks, running a temperature of 101 F. steadily for six weeks. He asked as to the duration of the longest case recorded as recovered.

DR. F. J. FARNELL spoke of seeing a large number of different types of infectious encephalitis at the Providence City Hospital. One case showed no symptoms except that he had been asleep for a week. The Wassermann reaction was positive, and under treatment the man improved. A child with so-called chickenpox and lethargy was admitted, and two weeks later showed blindness, later she developed mumps and scarlet fever and a cerebral hemorrhage with hemiplegia.

DR. GEORGE A. WATERMAN thought it was very difficult to determine just what conditions might be called postinfluenzal during the past winter, inasmuch as a large percentage of the population have had an illness called influenza since fall. In addition to the frequency of diagnosis of influenza, is the uncertainty of its correctness, as many physicians have termed every cold an influenza infection. He had seen several severe cases of myelitis, which occurred from one to three weeks after influenza; three of these cases were of the poliomyelitis type.

DR. E. W. TAYLOR doubted Dr. McDonald's justification of the grouping of the cases with lethargy as a separate disease. He had seen ten cases, some of them with marked lethargy. One of the cases cleared very quickly, but relapsed a week later. The patients understand more than they appear to. Some of the cases are possibly associated with infantile paralysis; others seemingly are toxic in origin; some show parkinsonian symptoms. Possibly the cases might better be grouped as cases of encephalitis subdivided into different types according to their most prominent symptoms, as for example the Parkinson, lethargic type, etc.

DR. McDONALD stated that he had seen one case of six weeks' duration, which was the longest continued case that he had seen, but the literature gave one case that lasted nearly three months. He felt that the literature seemed to justify the recognition of a disease entity, but that many cases seen on further study proved not to be true cases of encephalitis lethargica.

BOSTON SOCIETY OF PSYCHIATRY AND NEUROLOGY

*Regular Meeting, May 15, 1919*GEORGE A. WATERMAN, M.D., *President*

Instead of the usual papers various members of the society who had seen service in France or this country spoke informally of their observations and experiences as follows:

DR. WILLIAM JASON MIXTER: I feel rather ill at ease in talking to a neurologic society about my work with the American Expeditionary Forces because my work was largely nonneurological. I had expected, when I went over, to stick to clinical work, but owing to the exigencies of the service I was ordered to England the last of May, 1918, on account of the shortage of medical officers. I was appointed district surgeon of the Winchester district. This comprised four large rest camps in southern England, a number of aviation camps, two base hospitals and embarkation work at Southampton. Most of my work consisted of planning the development of new projects with two ideas in view: First, the care of the wounded coming to England from the American forces associated with the French in northern France and Belgium, and second, the care of American troops on their way through England to the front. The number of American troops that went through England in 1918, according to figures I saw in January, 1919, was 1,030,000. Most of these went through England in a few days, some in twelve hours and some in a week. These were the men we were dealing with in large measure, and our main problem was to keep them in as good physical condition as possible during that period, brace them up following their trip across the Atlantic and send them to France fit for their ultimate business. One of the first snags encountered was rations. The English ration of bread, cheese and tea for supper did not satisfy the Americans. After some difficulty a change in this order was secured. Then there was the question of caring for the American wounded returning from northern France, who were being spread in hospitals all over England. I arranged to get them more or less together. At the time of the signing of the armistice we had 12,000 beds in England full of wounded, and 5,000 more Americans in British hospitals. By the first of January our aim of 25,000 beds in England was accomplished. In order to have a hospital or district function well there must be close cooperation which can be secured if men are willing to get together occasionally and talk things over and plan just what each should do.

DR. ARTHUR H. RUGGLES: I will talk briefly on two or three types of neuroses which I saw and in which I was interested. Though they are not new to civil practice, I think they emphasize certain points as to etiology and something partially new as to treatment. The type that I want to speak of are the conversion neuroses. I use the term "hysteria" a good deal—"conversion hysteria"—and use "hysteria" rather broadly, covering some cases that probably many of you would consider anxiety neuroses, but I came somewhat under the influence of Colonel Hurst in England, who considers a very great majority of the neuroses as cases of hysteria, and some of the cases I shall describe really are major hysteria. The anxiety states, neuropathies and psychothenics that occurred as a result of conversion states, may or may not come into the general grouping of hysteria. The conversion

hysteria is much more common in the enlisted men than in the officers. Anxiety states are more frequent in the officers on account of the added responsibility. The most enviable position in the army, so far as the wear and tear on the nervous system is concerned, is that of the buck private.

I was for five months in a hospital in Scotland. At that time I do not think my mind was clear on the war neuroses and some of the men that I saw working there did not have the clear cut conception that more experience and opportunity for interchange of views gave them. The French were able to handle their problem at home, and called some of their best men in at the beginning. They had to consider their man power, and I do not believe any nation in the war knew as much about conservation of man power and carried it out to the degree that the French did. A man with a neurosis, just as a man with a flat foot, had to be returned to the front just as soon as possible, and the French were extremely successful in catching their cases early and returning them soon to the fighting line.

One of the cases I wish to report was that of a British officer seen in a British hospital. He was something of a problem for a time because he would not talk frankly. He came to the hospital with a most extraordinary gait and tremor, and when he attempted to walk he went through the most extraordinary contortions. It was not possible to get him to talk and it was supposed that a shell had exploded near him, and that he had subsequently developed the tremor and gait disorder. He resisted all forms of treatment, suggestion, persuasion, rest, exercise or reeducation, and it was only after a long and arduous time that we were able to get the following history: (which shows the personality and not remarkable reaction of that personality to the strain that he went through). He had lived the life of a country gentleman, and had not done much work. On his first hunting trip he killed a rabbit and was horrified at the sight of the animal's blood. After that he continued to ride and hunt but never killed, and could not bear the sight of a dead animal. The war came on and he felt that he should go, but had a conflict as his wife was pregnant and did not want him to leave, and the doctor said that he must not go as he was worried about her condition. He remained at home in a much disturbed state of mind as all his friends were going. After his wife was well he started off, still a good deal disturbed. He went to the front with a definite conflict, got into action and was simply overwhelmed with warfare. He could not bear the sight of a dead person or think of killing any one and could not sleep thinking of it all. He had frightful dreams and was much disturbed because he felt that he could not do his duty as a soldier. To strengthen himself, he used to walk through the cemeteries and trenches at night looking at and feeling dead bodies. His commanding officer was wounded, and he went to the hospital in the rear to see him. When he got down there away from the noise of the artillery he found the commanding officer comfortable and was much impressed by the situation. He felt that he could not go back and face things at the front again, and determined to commit suicide rather than go back. He had driven down on a motorcycle and going back purposely ran into a tree, but was merely thrown off. Three times after his return he tried to throw himself under a motor lorry, but was merely made unconscious for a minute. When taken to a hospital it was found that his legs would not hold him up and he developed this extraordinary gait and tremor. When he had told us his

history and we explained the mechanism to him and told him that his nervous system would not stand service in France and that he would be put on home service, he recovered.

That, of course, was called shell shock. This is one of the most pernicious terms. It is used to cover everything from delirium tremens to senile dementia. It not only covers all that, but is so much heard of that it has become a bugbear for the soldiers. It is not allowed in the nomenclature as a diagnosis but the corps men continue to use it. These patients make their own diagnoses and tell the doctor on his rounds that they have shell shock. It is only when you tell them that you do not know what that is and would like to know what they mean by it that they begin to see the light a bit. Only today I heard a Canadian nurse say that a great many of the Canadian soldiers married in France who had been married before and gave as an excuse that they had shell shock and forgot that they had been married. In addition, the soldiers and populace rather think shell shock a natural accompaniment of going to war. They also expected to be permanently disabled from it.

The second case is that of a sergeant in the regular army who had served nine years and had a very excellent record. In April, a shell exploded in some lime near him and splashed the lime into his eyes. This caused impairment of vision, enough to send him to the outpatient department to have his eyes washed out every day for a number of weeks. He did not remain in the hospital. He worried over losing his vision. He became interested in a French woman and when about to marry her received orders to move to another town. She felt that he was trying to escape her and brought suit for breach of promise. He was arrested and put in the guard house. He never had had a black mark against his record in nine years. On the ninth day, in the guard house, he developed complete blindness. He was sent to an American hospital for the blind, and there it was discovered that he had hysterical blindness and he was cured in one sitting.

The third case was that of an artillery officer who did well in the artillery. In October he thought he could do more in the flying service, and asked to be transferred. As a child he had what was called "growing pains," and his nurse talked about them a good deal to him. His legs had been the point of least resistance all his life. After being transferred to the flying corps, he did not do well. In the middle of October, he had influenza and with it a great deal of pain in the legs. When well enough to go back to duty he found, on attempting to fly, that his legs would not work. He was much disturbed as he thought he was making a mess of aviation. The armistice came, but he continued his training. He felt that he was of no use in the army, and would probably just kill himself in flying. He developed paralysis in both legs, with a great deal of pain. He was in bed four months and when finally seen was considered a functional case, and was cured in one sitting and restored to duty. He never went back to flying, but was able to rejoin his organization and came home with them.

In treatment the British at first were divided in their methods, treating by suggestion, reeducation and persuasion. The French have treated these cases largely by suggestion; in the early days the suggestion of an electric current and later by combined suggestion and persuasion with very good results. In the later days the British, under the direction of Colonel Hurst, have treated these cases largely by persuasion, going over the mechanism of the

case, the causative factors and the resulting mechanism in the individual, persuading the patient to use the function that is out of order and gradually increasing its use. I think this is a very logical method. The method of treating with electricity I have always thought gives the soldier the feeling that the condition was pretty severe since it necessitated this form of treatment, whereas the method by explanation and persuasion could clear the thing up in his mind and put him in a better position to resist a recurrence.

Colonel Hurst treats the functional cases without even making a careful neurologic examination. I feel that these patients should be examined. Colonel Hurst thinks that the patient has already tired of being examined but I do not think that one more examination would hurt, and it would impress these patients with the fact that you know something of their cases, and are in a position to deal with it. Many of Colonel Hurst's patients have an organic lesion with functional symptoms. He thinks that if you know there is an organic lesion present, your mind is rather convinced that the case is organic and not functional and your mental attitude toward the case will be very much less positive and in that way you will fail to cure the functional element. When he has completed what should be a cure, if there is any residual left, he makes an examination to determine whether it is organic. I think that is going at the matter backwards.

DISCUSSION

DR. STEDMAN then asked Dr. Ruggles how far psychoanalysis was used in these cases in his experience. Dr. Ruggles replied that in most of them there was no time for detailed psychoanalysis although there were evident complexes. Most of the men thought they got as good results by the direct question and answer method.

DR. THOM stated that he was particularly interested in Dr. Ruggles' statement in regard to hysteria in enlisted men as compared to officers. He never saw a case of hysteria in an officer in England, but at the American Base Hospital No. 117 among 3,000 patients, from 8 to 10 per cent. of them officers, he saw as many hysterical conditions in the officers as in the men. The percentage of deafness, aphonia, paralysis and blindness was as common in the officers as the men.

DR. A. WARREN STEARNS told of his experience in the navy. He was sent out to the Pacific Coast to a Naval Training Station to develop a psychiatric department which had previously not existed. A personal interview was determined on as a means of detecting the unfit. Occasionally as many as 500 men a day came in, and so the interview had to be brief. He found it easier to classify the men socially than mentally, and so attempted to detect any social handicap. Those found to be so handicapped were held for further examination.

Five points seemed to be of particular importance in making this initial survey: (1) Appearance; (2) geographical factor; that is, relation between home and place of enlistment, or evidence of wandering; (3) formal education; (4) occupation; (5) general health.

In this way recruits were divided into three groups. Those obviously well, comprising from 80 to 90 per cent.; those obviously unfit, comprising 1 or 2 per cent.; and a doubtful group held for further examination. Eighth grade education was considered usually to rule out mental defect. A high school career usually ruled out epilepsy, abnormal personality and congenital

conditions. Industrial stability was considered incompatible with mental disease. Various slides showing curves and charts were shown on the screen. The history card was as follows:

Name	Date	No.
Age	Civil Condition	
Home	Enlisted	
P. E.	Appearance	
School		
Occupation		
Med. Hist.		
Alc.	Arrests	
Symptoms	Fitness (1, 2, 3)	

The information in regard to industrial history was so classified that it proved of value in selecting men for special work. Group tests were used, a series being standardized, and his experience showed that you could predict future success or failure with considerable accuracy by means of mental tests. Moreover, it was possible to judge in what branch of the service a man was most likely to succeed.

It seemed to him that in classifying men four factors are of fundamental importance: (1) Physical condition; (2) capacity as shown by psychologic tests; (3) formal education; (4) industrial capacity.

From the foregoing it will be seen that each man is graded according to the navy standard on a basis of 1-2-3-4, as follows: (1) Inferior; (2) low average; (3) high average; (4) superior. Educationally: (1) Less than eighth grade; (2) eighth grade graduate; (3) high school students; (4) college. Industrially: (1) Misfits or failures; (2) unskilled; (3) experienced; (4) skilled.

In addition, each occupation has been given a serial number from 1 to 53. This makes it possible to give every man a numerical formula representing his capacity and training. The serial number representing his occupation is put at the right of a decimal point as it denotes a qualitative factor, the others being quantitative. For instance, 444.4 would represent a man of superior intelligence, college education, and highly skilled, his occupation being an attorney; 111.34 would mean inferior intelligence, education less than eighth grade and industrial failure, his work being odd jobs.

This forms a simple index, making it possible to locate and evaluate men easily. Also each number serves as a check on the other as a man with a 4 in his formula must be taken seriously, and a 1 means that he should be suspected of incapacity. As a matter of fact, the formulas are very consistent, it being rare to find both a 1 and a 4 in the same formula.

DR. DOUGLAS A. THOM: I wish to speak briefly of the work that I was sent over to England to do, to make a report of the British pension system. It is not a scientific talk but will give you an idea of the problem with which England has had to deal and with which the United States at present is confronted but to a lesser extent. There were no statistics available from the National Research Committee at the time I went over so that I had to get my information by talking to different men and by going to different hospitals.

The plan followed in England was this: The men were sent back from the front to hospitals in England and it was attempted either to get the man back to service or, if this did not seem possible, out of the army. A vast number

of functional neuroses patients were sent back and discharged uncured who had perfectly curable symptoms. Their papers were then sent to the Pension Office where recommendations were made on the disability. A man with a functional disturbance of both legs, for instance, would be considered a 100 per cent. disability. Then the papers were sent to the Pension Board and the man was asked to appear before this board or, if unable to do so, to be examined by a local physician who decided definitely on the amount of the pension. In that way the members of the Pension Board, who saw the case only from ten to thirty minutes, made the final decision as to the amount of pension to be paid. Consequently in England today there are about 20,000 functional hysterical patients. In 1917, about 75,000 came up before these pension boards, of which there were about a dozen in Great Britain. At first it was attempted to give these men gratuities running from \$75 to \$1,500. A man would spend it and come back to the Pension Board and demand more money, and if he did not get it, arouse a lot of criticism.

One difficulty in dealing with these men was that when once a man was discharged from the army there was no place for him to go as there were at the time of the signing of the armistice less than 400 beds in England for pensioners, and at the end of 1917 there were 50,000 of these pensioned neuroses in England without treatment and with no means of getting treatment. The pensions were inadequate, especially for the men with families, and a great deal of discontent ensued. (In this connection it is very important to bear in mind that it is much easier to treat the soldier as a soldier than as a pensioner. The greatest weapon that we had in dealing with the functional neuroses was the fact that we had some control over them. In the case of the pensioner he can refuse treatment if he wishes, and you cannot enforce it.) As the disability is reduced the pension is cut down proportionately by the pension board before which the pensioner has to appear at regular intervals. Of course, this leads to dissatisfaction.

At present, in England, many patients with hysterical symptoms of three or four years' duration are being treated and cured at one or two sittings. Many others have been wearing braces and supports and using mechanical appliances for two or three years and will not go to the hospitals. There will always be in England a considerable number of these untreated cases.

Of particular interest, I think, are the cases with convulsions. Personally, I have not seen a case of clinically certain epilepsy where convulsions were produced by the war. Undoubtedly, there were some in such a vast army, but they did not happen to come under my observation.

Another interesting observation probably made by many men was the association of hysterical convulsions with epileptic convulsions in the same person. It was quite surprising to find that patients that had given a history of epilepsy with remission would come back to the hospital and have typical hysterical convulsions so that it is to be considered that the therapeutic triumphs of some of the men of this country have been due to the fact that they have been treating hysterical persons for epilepsy in whom there was a large element of hysteria.

In conclusion I would say that:

1. No patient should be discharged from the army with any curable hysterical symptoms.
2. No patient should be discharged from the army as an epileptic until after he has been observed by a competent neurologist.

3. All cases of concussion and shell shock should be treated because all of these cases do well under treatment.

4. The gratuity system proved unsatisfactory in England and should not be used under any circumstances.

5. The neuroses should have special hospitals with staffs of specially trained men.

In this country at present the War Risk Insurance is taking over the care of the soldiers if they are discharged, but such a discharged man can accept or refuse treatment. There is no way at the present time to hold a man sent to an army hospital for the insane.

In England 10 per cent. of all the men mobilized were asking for pensions. In this country a great many are going to ask for pensions.

It might be of interest to state that there were 18,800 cases of insanity in the English forces and of these only 3,000 were sent to institutions. The rest were allowed to be taken home because public sentiment in England forbade sending soldiers to institutions for the insane. Parents came demanding 100 per cent. disability, and took the men home. I trust that in this country when the insane soldiers are returned home that some adequate measures will be taken to care for them and that they will not be allowed to go to their homes simply because parents wish it. There is too much sentiment attached to the soldier at the present time for his own good, and particularly for the good of the community where he will have to reside.

DR. JOHN J. THOMAS: My work while in France was largely with the base hospital as chief of the medical service, but I was also appointed as consultant to other hospitals in the district. Consequently, I saw a number of neurologic cases outside of our own hospital. The American hospital problem in France was different from that of the other nations because we were so far from home. Owing to the shortage of beds in France in proportion to the number of men engaged, it was impossible for us to keep a man long in a hospital, and those that promised to be cases of long duration had to be permanently evacuated to this country. That affected the handling of the neuroses. Colonel Salmon early devised a most excellent method of handling these neuroses, and established Base Hospital No. 117 for their treatment. It was located at Chaumont, back of that part of the line which was expected to be taken over by the American army, but changes in the plans and advance of our lines made it impossible to get all of these cases back to the base hospital. This problem was met by establishing three other hospitals near the front. In this way these functional cases were largely prevented from getting back to the general base hospital, and came under the care of men trained in their treatment. I think a large percentage of these cases were well in a short time. Schwab reports that 65 per cent. were sent back to the line. (The object in military life is to get a man well and back to the line as soon as possible and you have a tremendous leverage in treatment in having men under military control.) The more severe cases came to Base Hospital No. 117, but a great many of these were put back in shape and into the line.

The handling of neuroses in the army is a difficult problem, especially the distinguishing functional from organic symptoms. The French speak a good deal of a concussion syndrome, but most of the neuroses that I saw were pure neuroses, and not cases of melancholia which differed a little from what we see here. In a French hospital at Tours I saw some cases demonstrated by the

physician in charge as pseudoparesis, which seemed to be due to the fatigue and exhaustion of the front line. In general, they were somewhat similar to paresis with ideas of grandeur and considerable mental deterioration, but without positive laboratory or physical signs.

Although the work of the psychiatrists may have been very good, many men came to France with mental defects.

When I was in England, in 1915, I saw more wounds of the brain than I did the whole time I was over on my second trip. The reason for this was undoubtedly the use of the steel helmet. Most head injuries did very well. The wounds of the spinal cord were fully as discouraging as those seen in 1915. This was probably due to the high velocity of the bullets used in modern warfare. Many of the patients died. About 30 per cent. of the wounded extremities showed some paralysis and the great difficulty in treating injuries of the peripheral nerves was due to the great distance from home and the lack of beds. As a result, many of these had to be left for secondary operations after they got home with less chance for recovery.

CHICAGO NEUROLOGICAL SOCIETY

*Special Meeting, May 27, 1919, Held at U. S. Army General Hospital 28, on
Invitation of the Commanding Officer, COL. WILLIAM N. BISPHAM*

NERVE REGENERATION AND NERVE SUTURE. Presented by
LIEUT.-COL. DEAN D. LEWIS.

Colonel Lewis said that within two hours after section of a mixed nerve, evidence of the first step in regeneration could be detected. This first step is the formation of delicate protoplasmic bands which probably originate from the nuclei of the neurilemma. These bands spring from both proximal and distal stump but those from the former are more important, being four times as active as the latter. The protoplasmic bands bridge the gap between the ends, when these are not too far apart, and serve as conduits for the neurofibrils which grow out from the proximal stump. These are produced in great number, many times the number needed for a normal nerve, each axis cylinder sending out a host of them in quest of the distal stump.

When a gap has to be bridged by a transplant, an autogenous transplant is best. The neurofibrils do not penetrate a heterogenous transplant but grow down along its surface. Theoretically, the best transplant would be an auto-transplant with Wallerian degeneration; that is, a nerve about nine to twelve days after division, but experimentally such a bridge has not been found to be superior to a piece of normal nerve.

A so-called neuroma forms on the proximal stump in about nineteen days and is made up principally of spirals of neurofibrils which turn back and wind about the axis cylinders, and of ovoid pads which form on the end of the neurofibrils. Experimentally, it has been found that injection of the nerve with alcohol prevents the formation of a neuroma.

Colonel Lewis advocated neurolysis instead of nerve suture unless there is undoubted anatomic block in the nerve. In many cases the nerve is injured by the projectile but not divided, and a frequent type of lesion is that in which the nerve is embedded in a dense cicatrix of surrounding tissue which causes physiologic but not anatomic block. These are cases for neurolysis.

Colonel Lewis operated on two patients before the society. The first was one of high explosive wound reaching from the greater trochanter to the gluteal fold with paralysis and wasting of all muscles below the knee, some trophic disturbance, no pain. The nerve was found in the midst of scar tissue and obviously had been injured, as at one point it showed a hard fusiform enlargement or nodule. The nerve was freed from enveloping cicatricial tissue and then at the point of the indurated enlargement the hard and thickened sheath was trimmed off with scissors. After removal of considerable tough tissue the nerve where injured was reduced almost to normal size and consistence. In the opinion of the operator this was a much better procedure than to excise the inch or two of indurated nerve and suture the ends. The nerve was then embedded in or surrounded by muscles and the wound closed. The prognosis was considered to be good.

The next case was one of extensive shell wound at the upper third of the forearm involving both ulnar and median nerve. The former had largely recovered, but there had been no motor or sensory improvement in the distribution of the median nerve. This was exposed at the upper part of the wound and traced downward until a definite proximal stump was reached. The operator then looked for the distal stump which finally was located about 2 inches lower. As there were extensive scars from elbow to wrist, it was borne in on the spectator that for such surgical procedures the operator must not only *know* the anatomy, but must be intimately familiar with all tissues in the region and must be a surgeon of great skill and tenderness. In this case the ends could not be approximated so the cutaneous branch of the radial was dissected out, a piece excised and used as a transplant, being sutured to the trimmed proximal and distal stumps of the divided median. Transplant and stumps were enveloped in muscles and the wound closed. For tubulization of sutured nerves, fat, fascia, corgile membrane, calf's artery, etc., have been used, but Colonel Lewis believes that all hemorrhage having been controlled, muscles make the best envelope. Colonel Lewis said that the advisability of operating on nerves in the forearm, especially in its lower part, was questionable because the disability caused by the lesion is not great and the postoperative pain is apt to be prolonged and severe. Stiles of Edinburgh and some other surgeons do not operate on such cases. Replying to a question, Colonel Lewis said that he was not an advocate of stripping vessels or nerves of their sympathetic network for the relief of causalgia. He thought the injection of 50 per cent. alcohol into the nerve a better procedure. It relieved the pain, and by the time the effects of the injection wore off the causalgia would have recovered.

Colonel Lewis then presented some patients, although none of them had been operated on long enough to permit one to say anything about the outcome, except those in which neurolysis had been performed. He had on the service some cases in which primary suture was performed in July and August of last year, and there was distinct return of motor power with almost complete return of function.

Two cases that he presented had shown very distinct evidences of return of motor power after neurolysis. One case was one of constriction by a fine cicatricial band, following a high explosive wound of the left arm associated with fracture of the humerus. There had been complete physiologic interruption for six months. The cicatricial band was divided and a muscle neurolysis of the nerve performed. The dissection used to expose the nerve

was made along the intermuscular septum, as few muscle fibers as possible being divided in order to avoid hemorrhage. Within ten days after this operation was performed there were distinct evidences of return of motion in the radial extensors of the wrist. The improvement continued and had been rapid.

In the second case, a machine gun bullet perforated the right arm high up. The bullet had evidently passed along the musculospiral nerve. Physiologic interruption of the nerve had existed for over six months. The nerve was exposed on the inner side of the arm high up before it enters the musculospiral groove. The epineurium was found thickened in two places, and the nerve was imbedded in scar tissue. The nerve was dissected out of this and placed in a new bed. Within twelve days after this operation there was a return of motion in some of the extensor muscles.

Neurolysis is of distinct benefit in such cases for it undoubtedly hastens return of function and prevents the disabilities which arise from continued inactivity of paralyzed muscle groups.

In performing neurolysis, muscles which are comparatively healthy should be used to make the new bed. The dissection, therefore, should be made along intermuscular septums so that the hemorrhage will be reduced to a minimum. When dissected free, the nerve involved is placed in the new muscle bed. This type of operation is to be preferred to the use of free fat, cargile membrane or of a calf's artery hardened in formalin. It is the most satisfactory type of operation for this purpose.

When the nerve has been divided, an end to end suture should be performed. While some doubt has been thrown on Stoffel's work dealing with the internal topography of peripheral nerves, there is no doubt that nonaxial rotation of the nerve is to be desired and that an accurate end to end approximation of corresponding funiculi should be attempted. Epineural sutures of fine catgut or silk are used for this purpose. These epineural stitches pass a little deeper than the epineurium and obliterate any space that might exist between the ends of the nerves. When long defects exist, an attempt to secure end to end anastomosis by posture or displacement of the nerve segments is attempted. He had secured an end to end suture of the sciatic, when the defects measured 7.5 cm. by mobilizing the segments of the nerve and flexing the knee joint.

Defects in the ulnar above the elbow joint may be bridged by dissecting the ulnar nerve out of the groove behind the epicondyle, and displacing it anteriorly, and by flexing the forearm. In all cases where possible, an end to end suture should be made.

If the defect cannot be overcome, nerve grafting should be resorted to, using the autocable graft advised by Huber or calve's fetal sciatic nerve, preserved in 50 per cent. alcohol, as suggested by Nageotte.

These last methods give only a small percentage of successes. Tubulization is uncertain and should be used only in those cases where no other methods can be applied. Resection of a bone, such as the humerus, to overcome a defect in the musculospiral should not be employed. Lateral implantation of a nerve into a neighboring nerve, using the sensory part of the nerve to carry the fibers downward, may be used in cases where the defect cannot be overcome by the ordinary methods. This procedure is practically autotransplantation.

METHODS OF EXAMINATION AND SUPPLEMENTARY MUSCLE MOVEMENTS IN PERIPHERAL NERVE LESIONS. Presented by MAJOR LEWIS J. POLLOCK.

The examination of the motor functions of the patients suffering with lesions of the peripheral nerves was conducted by means of a spring scales and the results noted on a chart showing the imprint of a hand or a foot, in terms of pounds or ounces of pull. This method enabled him definitely to determine the extent of movement of each segment about a joint and called his attention to certain seeming discrepancies which he demonstrated (Fig. 1).



Fig. 1.—Testing the pronator with spring scales method.

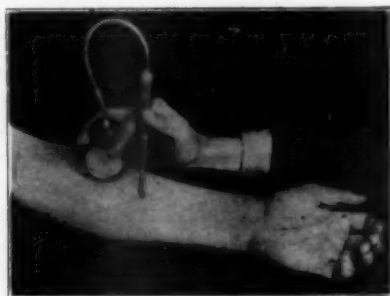


Fig. 2.—Tonometer.

Record of contractures and range of motion was obtained by molding a lead tape about the segments of joints and tracing the outline on paper (Fig. 3).

Imprints of hands and feet were taken and revealed certain characteristic pictures. In many cases the degree of atrophy was shown more clearly by this method than by photographs (Fig. 4).

Tone was measured by ascertaining the millimeters of mercury necessary to insert a blunt plunger a certain distance into a muscle mass. It was found that only for a short time after a peripheral nerve lesion was incurred, was this method practicable. After fibrosis occurred the resistance to pressure occurred as the result of factors other than tone and the method had to be discarded. In the former instance the difference between normal and paralyzed muscles would be as between 180 and 140 mm. of mercury (Fig. 2). Atrophy

was measured by the water displacement method. Contrary to accepted theories, the degree of atrophy did not bear a constant relation to the severity of the lesion. Many cases that were recovering or had recovered showed a great amount of atrophy, whereas cases of complete anatomic division of nerves showed but little. For example, a recovered sciatic nerve lesion showed 500 gm. of loss, whereas a case of a completely severed sciatic nerve with no regeneration showed but 100 gm. of loss. The degree of atrophy is dependent more on the amount of massage, electricity and passive movements the extremity has had than on the severity of the lesions.

The method of sensory examination differs from that ordinarily employed only in the employment of a wisp of cotton saturated with ether to test extreme degrees of cold. This method is more accurate, simple and convenient than the employment of test tubes.



Fig. 3.—Method of recording range of motion.

Major Pollock called attention to the large and constant overlaps of the peripheral nerves for prick pain and showed cases of combined ulnar and median nerve lesions in which the anatomic area of the sensory portion of the median nerve, with the exception of the distal phalanges, was overlapped by the musculospiral and musculocutaneous nerves. This overlap should not be interpreted as a sign of recovery, and return of sense of prick pain in the area of possible overlap would have to be ruled out in studying regeneration.¹

Major Pollock showed about thirty patients to illustrate various "supplementary movements." (Abstract appears as original paper in this issue.)

1. An original paper on this subject will appear in a future number of the ARCHIVES OF NEUROLOGY AND PSYCHIATRY.



Fig. 4.—Imprints of (a) sciatic lesion; (b) normal foot; (c) lower brachial flexus; (d) partial median; (e) ulnar; (f) ulnar; (g) ulnar and median; (h) median; (i) ulnar and median.

CRANIOPLASTY. Presented by MAJOR DALLAS B. PHEMISTER.

Major Phemister performed an operation to illustrate one method of repair of a large cranial defect. On Oct. 5, 1918, the patient had been struck on the head by a bit of high explosive shell which had carried with it a fragment of the soldier's helmet three-quarters inch into the brain in the left parietal region. The patient was not rendered unconscious and had no aphasia, but the right leg and arm were paralyzed. The arm had recovered to a considerable extent, but the leg was still quite paretic. In the last five months the patient had had six jacksonian fits.

The slightly oval cranial defect was about $1\frac{1}{2}$ inches in diameter, and as defects of this size do not grow less, it had been decided to fill it with a bone transplant. The outer table was removed all around the edge of the defect, leaving the inner table. Thus was prepared a narrow shelf or ledge on which would rest the edges of the transplant. This was cut from the outer table of the parietal region of proper size and shape to fit the defect, care being taken to preserve the pericranium. In chiseling this transplant from the inner table it was cracked into several fragments, but the pericranium held them together and the whole was fitted into the defect and secured by suture. Such transplants grow fast to the surrounding bone, retain their vitality, supply adequate protection and, what is not indifferent to the patient, constitute a marked cosmetic improvement.

The American Medical Association will pay 50c each for the April and May, 1919, issues of the ARCHIVES OF NEUROLOGY AND PSYCHIATRY. Address to American Medical Association, 535 North Dearborn St., Chicago, Ill.
